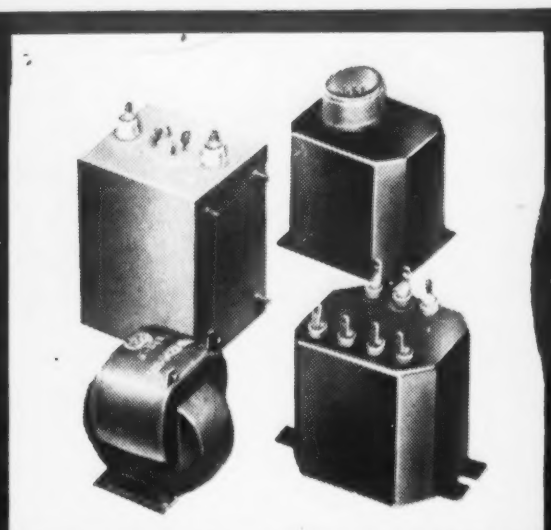
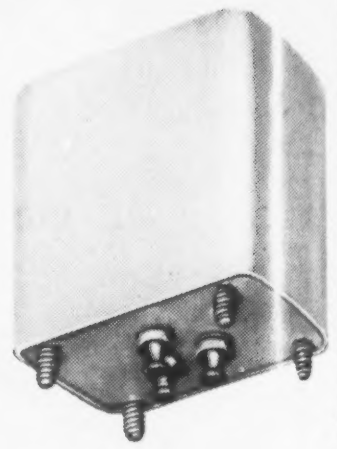
OUR 10 MILLIONTH MILITARY UNIT SHIPPED THIS YEAR

Military Components
FOR EVERY APPLICATION

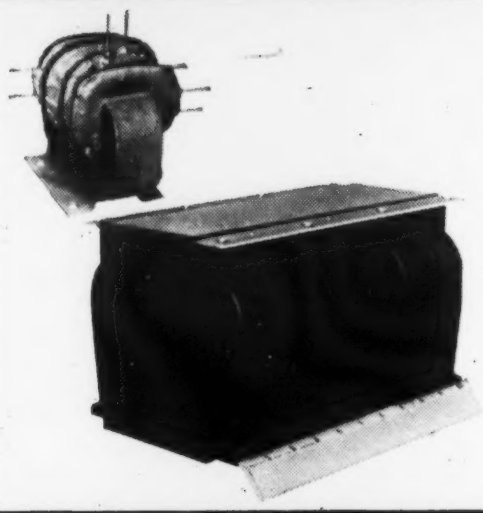
A HUNDRED STOCK UNITS in our catalog B...30,000 special designs





FILTERS

UTC filters, equalizers and discri-
nators are produced in designs f
.1 cycles to 400 mc. Carrier, airc
and telemetering types available
standard designs.



ENCAPSULATED UNITS

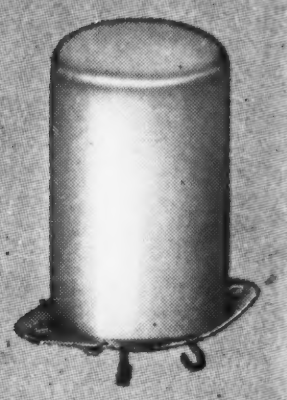
8 years of encapsulation experience assure maximum reliability in this class of UTC material.

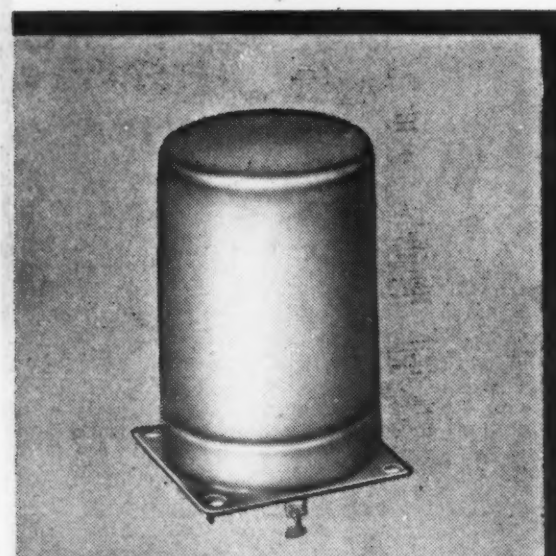
MOLDED UNITS

UTC molded units range from ⅓ oz. miniatures to the 100 lb. 3 phase unit illustrated.

PULSE TRANSFORMERS

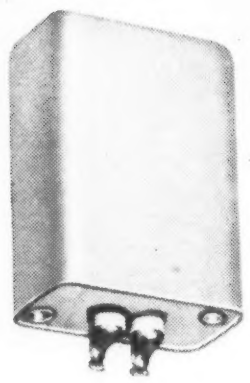
UTC pulse transformers cover the range from molded structures weighing a fraction of an ounce to high power modulator applications.





AUDIO COMPONENTS

UTC military audio units range from 1 ounce subminiatures to high power modulation transformers. Standard, high fidelity, sub-audio, and supersonic types.

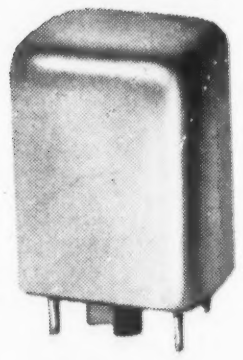


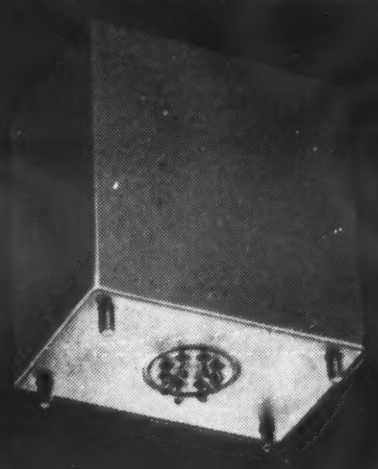
HIGH Q COILS

Unequalled stability is effected in UTC high Q coils thru special processes and materials. Toroid, mu-core, and variable inductors are available to military standards.

MINIATURIZED COMPONENTS

UTC H-30 series audios are the smallest hermetic types made. Class A, B, and H power components of maximum miniaturization are regular production at UTC.





UNITED TRANSFORMER CO

150 Varick Street, New York 13, N. Y. EXPORT DIVISION: 13 E. 40th St., New York 16, N. Y. CABLES: "ARL

Telephone Diary

HOUSEWIFE TELLS HOW FAMILY'S TELEPHONES SAVE STEPS, TIME AND WORRY—DAY AND NIGHT

4 A. M. Jack's a sound sleeper but he woke up fast when he heard the news. "It's a boy!" he shouted. "Nearly eight pounds. Mary's fine." Then I talked and Jack talked. Bless that bedroom telephone!

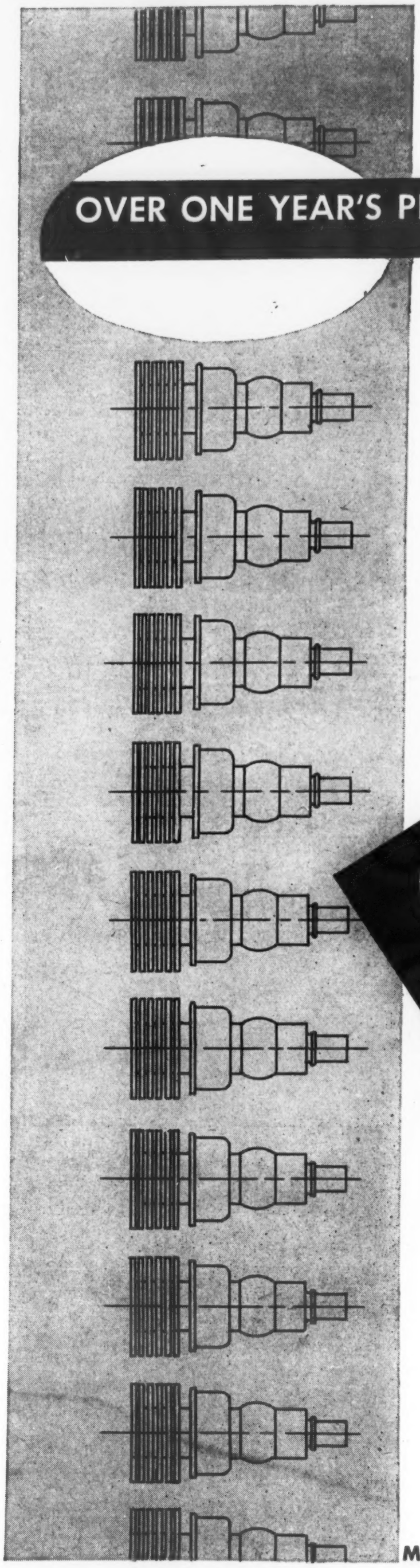
8 A. M. to 11 A. M. Just couldn't wait to tell Betty and Peggy about the baby. Then I ordered Jack's favorite roast for dinner and was lucky to get a hairdresser appointment. A grandmother must keep young!

5 P. M. Wouldn't you know! The very night I have something special for dinner Jack gets held up at the office. But it wasn't too bad. He telephoned he'd be an hour late. It's wonderful to have a telephone in the kitchen.

10 P. M. Such excitement! First Jack Jr.'s baby. Then Alice tells us she's engaged. I wasn't too surprised because of all those telephone calls and dates. I'm so glad it's that nice Bob Johnson.

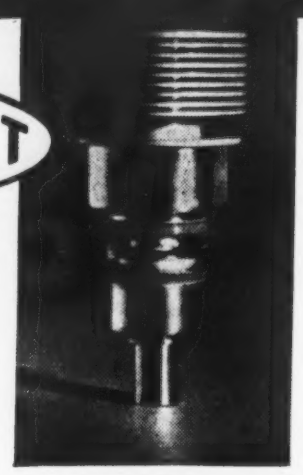
EVER READY...EVER HELPFUL. Day or night, rain or shine, the telephone stands ready to help you in the everyday affairs of life as well as emergencies. In office and home, these oft-repeated words reveal its value—"I don't know what I'd do without the telephone."

BELL TELEPHONE SYSTEM



OVER ONE YEAR'S PRODUCTION UNDER RIQAP – ML-2C39A

MACHLETT



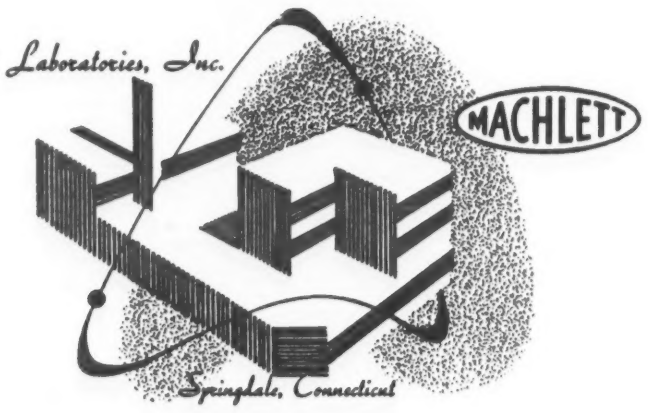
UNITED STATES ARMY SIGNAL CORPS

Only a limited number of manufacturers have qualified so far under RIQAP—the United States Army Signal Corps' Reduced Inspection Quality Assurance Program. Of these, Machlett Laboratories, Inc., was the first manufacturer of transmitting tubes to be approved for operation under the plan.

Machlett has now completed well over a year's successful production under RIQAP—a year of convincing evidence that this plan is ideally designed to achieve the mutual objective of users and producers alike for better quality, more reliable, electronic products.

All electron tubes of Machlett manufacture, regardless of type, are produced to the same rigorous, diligently maintained, high quality standards necessary to achieve "Approval Under RIQAP" recognition.

Machlett Laboratories, Inc.



MACHLETT LABORATORIES, INCORPORATED—Springdale, Connecticut

1624 Eye Street, NW
Washington 6, D. C.
Phone: EXecutive 3-3033

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SIGNAL

Communications-Electronics-Photography

Journal of the Armed Forces Communications and Electronics Association

VOLUME 10 NOVEMBER-DECEMBER 1955 NUMBER 2

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Mounted in a Navy "Viking 12" rocket, a camera photographs the California-Arizona area from an altitude of 143.4 miles as the rocket begins its descent. For an interesting and inofrmative article about rockets and satellites, see "Man-Made Satellites" on page 17.

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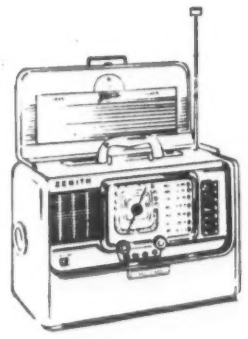
Authors are entirely responsible for opinions expressed in articles appearing in AFCEA publications, and these opinions are not to be construed as official or reflecting the views of the Armed Forces Communications and Electronics Association.

Where in the world was the radio the Army wanted?



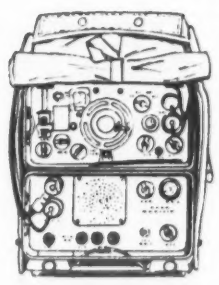
The year was 1952. The army wanted a radio that would build morale by letting servicemen hear home, wherever in the world they were sent.

Such a set would have to work under extreme hazards of arctic cold, tropic humidity, uncertain power supply...

Where did the Army find it?

Here at Zenith. It was the famous Zenith TRANS-OCEANIC® shortwave portable, already a veteran of 11 years of rugged service all over the world. It had been tested and proved under countless "impossible" conditions. No other radio could touch its performance record. The Army asked Zenith to make a few adaptations in this famous radio, and it was ready, as the R-520/URR, for government service.

Being ahead of the times in radionics is Zenith's specialty. We are proud that our experience in bringing better things to the American people can serve the Government.



Zenith's experience in shortwave made them a logical producer of the Army's AN/GRR5. This powerful shortwave radio is used by the Army for receiving messages in the field under very gruelling conditions. It is another example of the benefit of Zenith's 36 years of "know-how" brought to Government service.

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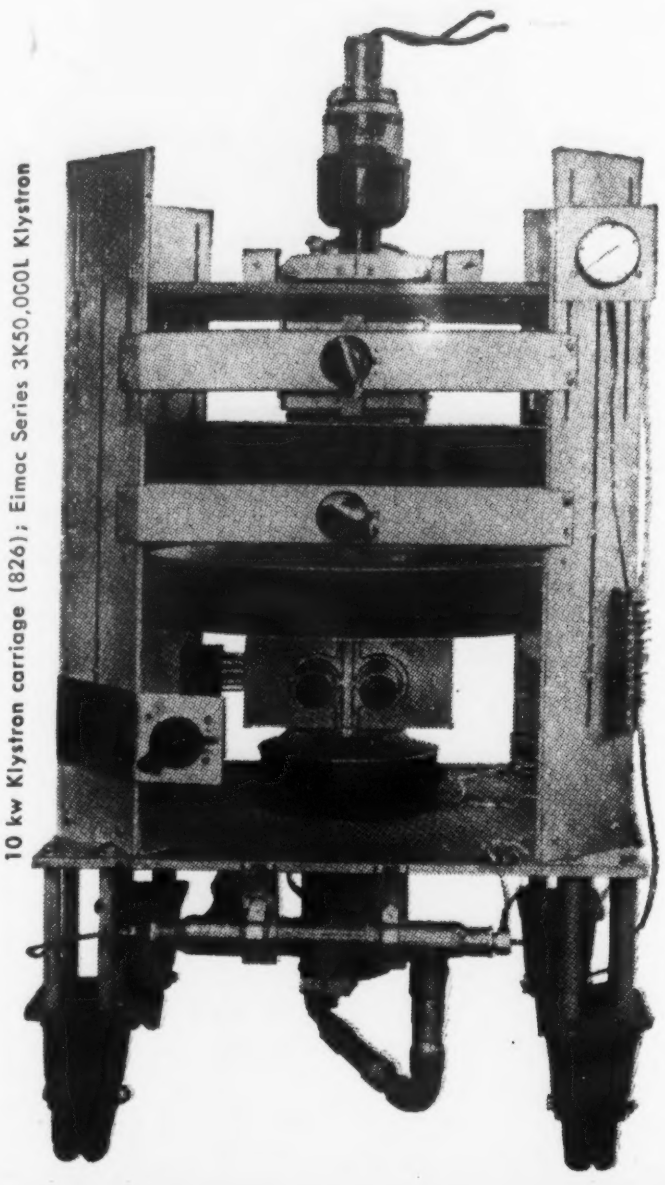
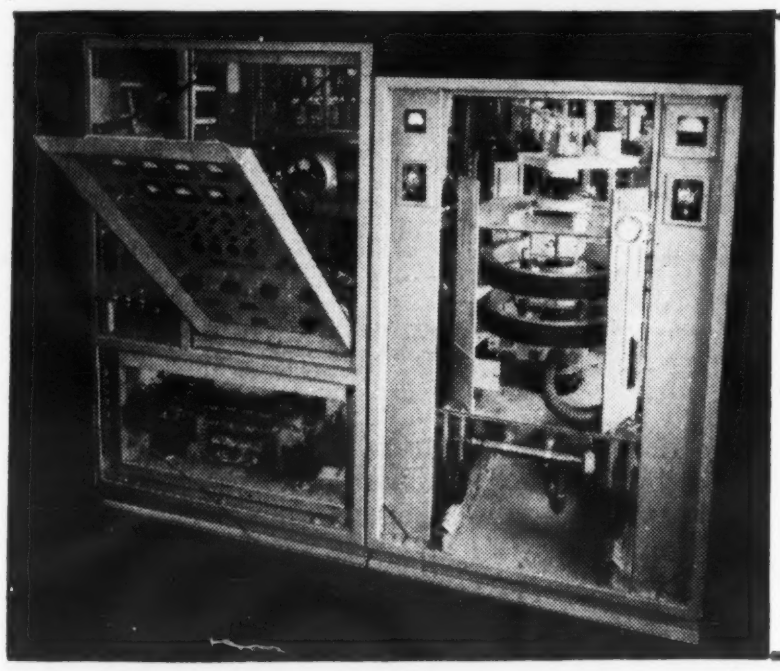


10 kw Klystron carriage (826); Eimac Series 3K50,000L Klystron

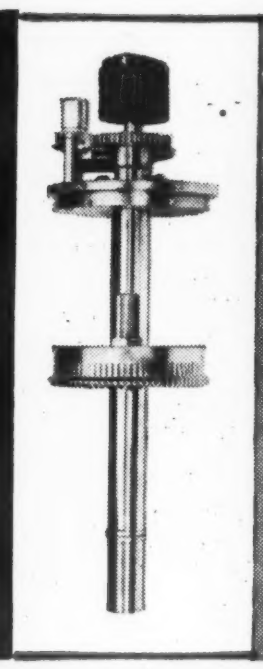
GIANT STEPS

More beyond-the-horizon FM multiplex relay equipment by REL is in operation than that of all other manufacturers *combined*. No need to wait for time-consuming developmental engineering; Type 826 and 827 Terminals are standard items in the REL line of point-to-point communications gear. Each terminal includes an exciter, a dual diversity receiver with combiner or switch, as determined by application, and a Klystron power amplifier: 10 kw for the 826 and 1 kw for the 827.

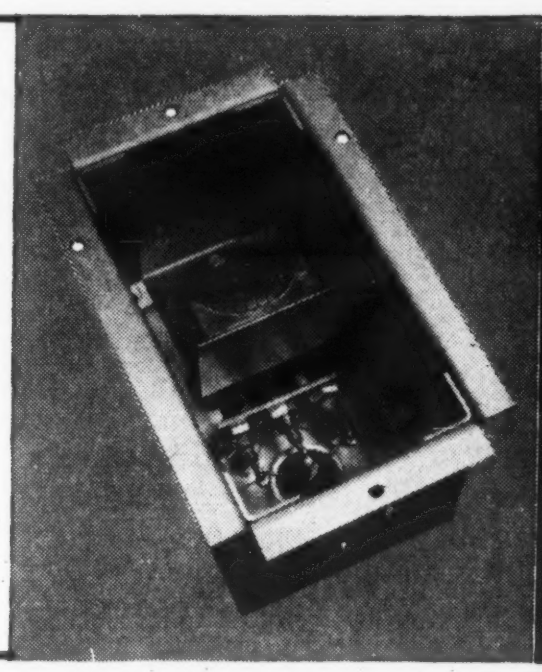
Carrier frequencies are available for both systems from 400 to 1050 mc, with base band options from 30 to 600 kc. Associated receivers have noise figures from 5.5 to 9 db, depending on frequency. Descriptive specifications may be obtained upon request.

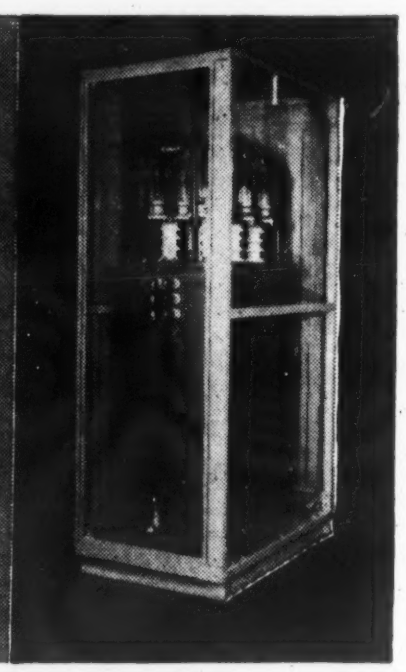


Power amplifier and control panel (826)



Receiver tuning assemblies (826 and 827)





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Now *parallel* all-weather airlanes can be marked off in the sky by electronic means . . . airlanes that lie side by side, only a few miles apart, yet never meet. This can now be accomplished through a single airborne "package" that measures the distance and bearing to a known ground station and, through a computer, produces courses with a precision never before attained.

Thus, in heavily-traveled areas, multiple and accurate routes can be provided for aircraft to fly safely and efficiently, maintaining heavy traffic schedules in adverse weather.

TACAN is the result of a series of development programs sponsored by the U. S. Navy and the U. S. Air Force at Federal Telecommunication Laboratories, a division of IT&T. Federal Telephone and Radio Company, division of IT&T which now manufactures the military version of TACAN, will also manufacture and market the commercial aircraft and private flier versions of the equipment.

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Now quickly and accurately detect "positive grid" conditions in amplifier tubes used in circuits employing a high value of grid return resistance. EXCLUSIVE!

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Tubes in this category are found in all types of electronic equipment. The grid circuit condition must be "clean", if one expects peak performance. The following are examples of circuits where the GCT-5 can do an outstanding culling job in order to achieve this high degree of performance perfection:

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The SECO GCT-5 also detects other common leakages and shorts like other tube testers except that with the SECO GCT-5 only a single preliminary filament selecting adjustment is made and the instrument is set for all tests.

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We can also equip you with a tester for specialized applications, to exactly fit your needs.

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Minneapolis, Minn.

Memo to SIGNAL Readers:

Resources Unlimited If . . .

We live in the wealthiest nation on earth, yet we are in danger of destroying through neglect and lack of cultivation our largest single resource—the mental capacity of our youth. We are not raising a nation of illiterates, but we are neglecting those children with the minds needed to maintain our present high standard of scientific and technological progress.

Natural scientific and technological ability is not all that a child must have to enable him to keep his country ahead of all others in the benefits which science has brought to us. The teachers, facilities and incentives must be provided to encourage our youth to continue the progress we have made. With America entering the first phase of the so-called "atomic age," we find ourselves in the precarious position of having a declining percentage of high school students enrolled in such basic courses as elementary algebra, plane and solid geometry and physics.

Allison C. Neff, president of the National Society of Professional Engineers, has said that "Without a high school background in elementary mathematics, a young person entering college is severely handicapped, and often all but blocked, in the pursuit of an engineering career." Recent studies give the current picture in the following three sentences:

1. Only about 25 per cent of our high school students are now studying algebra.
2. Only about 10 per cent of our high school students now study geometry.
3. There are many small and even some large high schools which offer no courses in the physical sciences.

According to Donald A. Quarles, Secretary of the Air Force, "The critical shortage of engineers and scientists in America is potentially a greater threat to our nation than any weapons known to be in the arsenals of aggressor nations."

Since 1950, the number of technical graduates has been decreasing at an increasing rate. It has now leveled off at less than half the 1950 figure. This decline has occurred at a time when advances in technology have imposed mounting requirements for technical personnel in industry. The need for engineers, scientists and technicians has increased while research and development demands have multiplied, and at an almost unbelievable rate where design and production have become infinitely complex.

The only way we can find the answer to these problems is to assure that America has an adequate number of scientific and engineering personnel, and that their energies are devoted to this end.

The element of time which favored us in past emergencies by giving us many months to mobilize resources and train personnel already has been nullified by the ability of enemy nations to launch all-out attacks against our homeland without warning.

Reports from the Soviet Union indicate that the Reds are exerting intensive efforts to channel the interests of Communist youth toward science and engineering. Elementary and secondary schools stress science and mathematics. Incentives are provided for advanced students in engineering and science, and liberal rewards are given to their working scientists and engineers.

It has been estimated that this year the Russians graduated approximately 50,000 engineers—more than double the number who received degrees from U. S. colleges and universities. An estimated additional 50,000 Russians graduated as subprofessional engineers and highly trained technicians.

Certainly there is no desire in America to regiment or to mold the minds of youth as do the Russians, but there is a grave responsibility on the leaders of Government, of education, and of industry to provide new motivation and incentive for our youth to enter engineering, scientific and related fields.

The future course of American industrial achievement and national defense will be largely dependent on the engineering skills which can be developed from the generation now in high school.

The Editors

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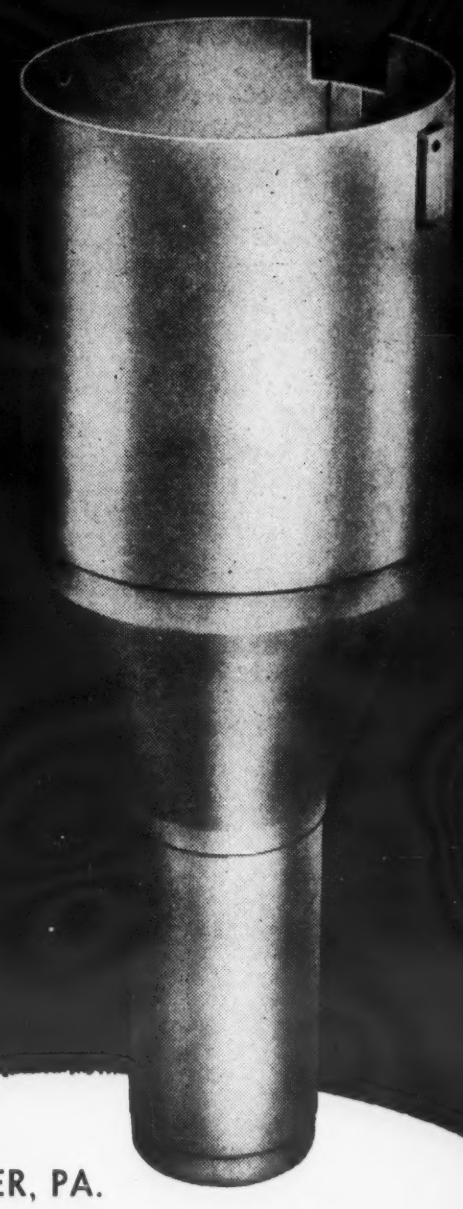
WHY TAKE LESS?

You're time and money ahead with Performance-Guaranteed Magnetic Shields, for our shields are *guaranteed* to meet the requirements of your circuit to mutually agreed upon shielding specifications. Dry hydrogen annealed, as required . . . of MuMetal, A.E.M. 4750, or whatever commercially available material is most suitable . . . fabricated or drawn . . . painted or lacquered to match any shade, or unfinished. Write for the industry's most complete catalog, MS-104, today.



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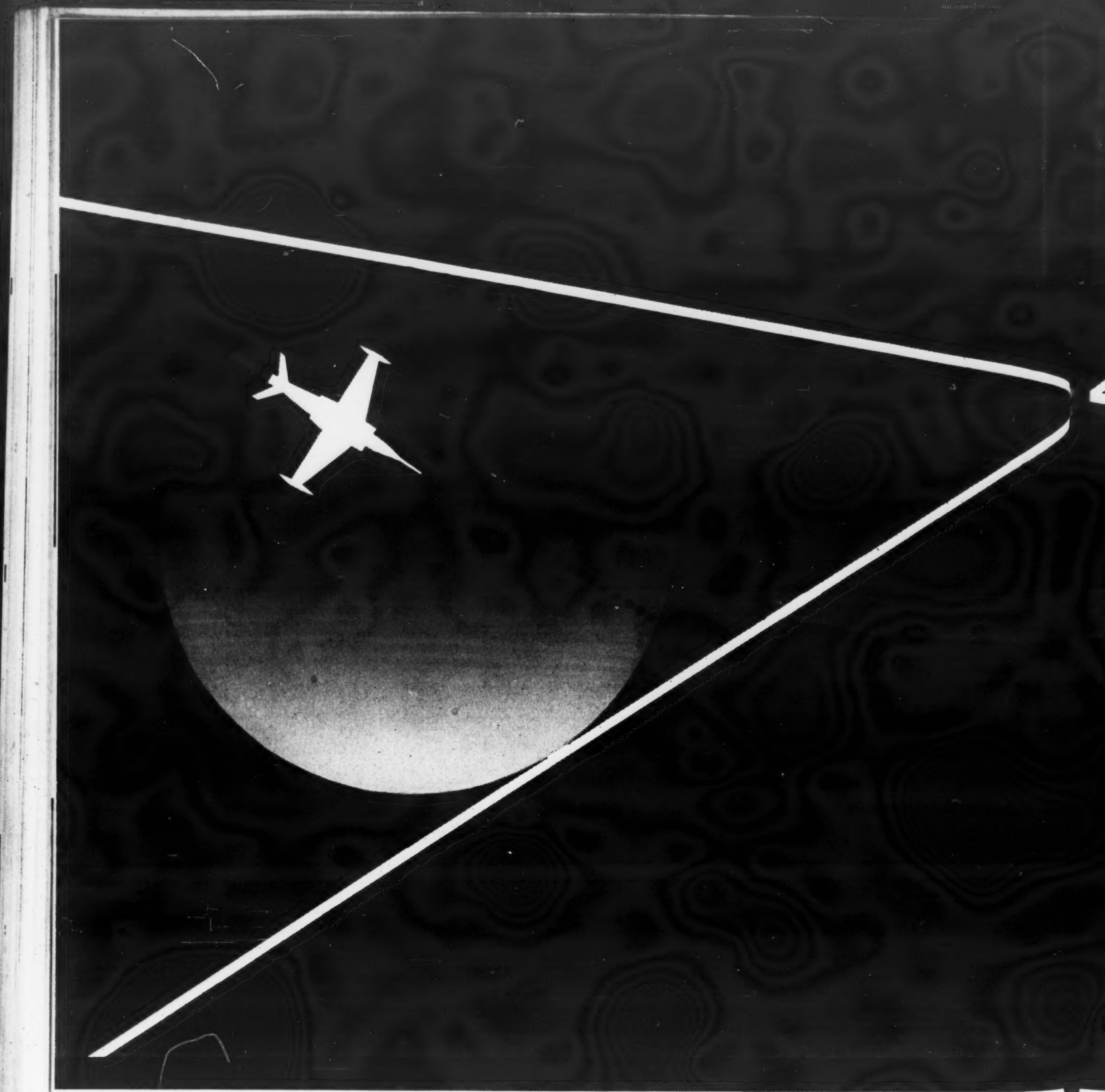

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Crosley

From Crosley— new dimensions for the electronic age

As electronics works its magic for defense and industry, scientists of Avco's Crosley Division reckon with the problem of making already reliable electronic systems more flexible—to give them greater usefulness in navigation, communication, national defense. Now, out of intensive study of electronics and related areas—thermodynamics, optics, aerodynamics, human factors—has emerged the knowledge necessary to achieve this critical goal. Working closely with the military, outstanding Crosley scientists have changed the dimensions of many electronic systems: lightening them, compressing them, "miniaturizing" them. Now—improved radar, communications receivers, navigational aids, and scores of other systems are coming off the Crosley lines and performing their miracles in smaller space, with less weight, requiring less power. Through "miniaturization" in electronics, as well as advances in air-frame assemblies, Crosley brings the findings of research to practical fulfillment—for defense, for peace.

If your plans are linked to advanced electronics, find out how Crosley's capabilities and knowledge can be brought to bear on your specific problems. Wire, phone or write for Miniaturization Booklet to Avco Defense and Industrial Products, Stratford, Conn.

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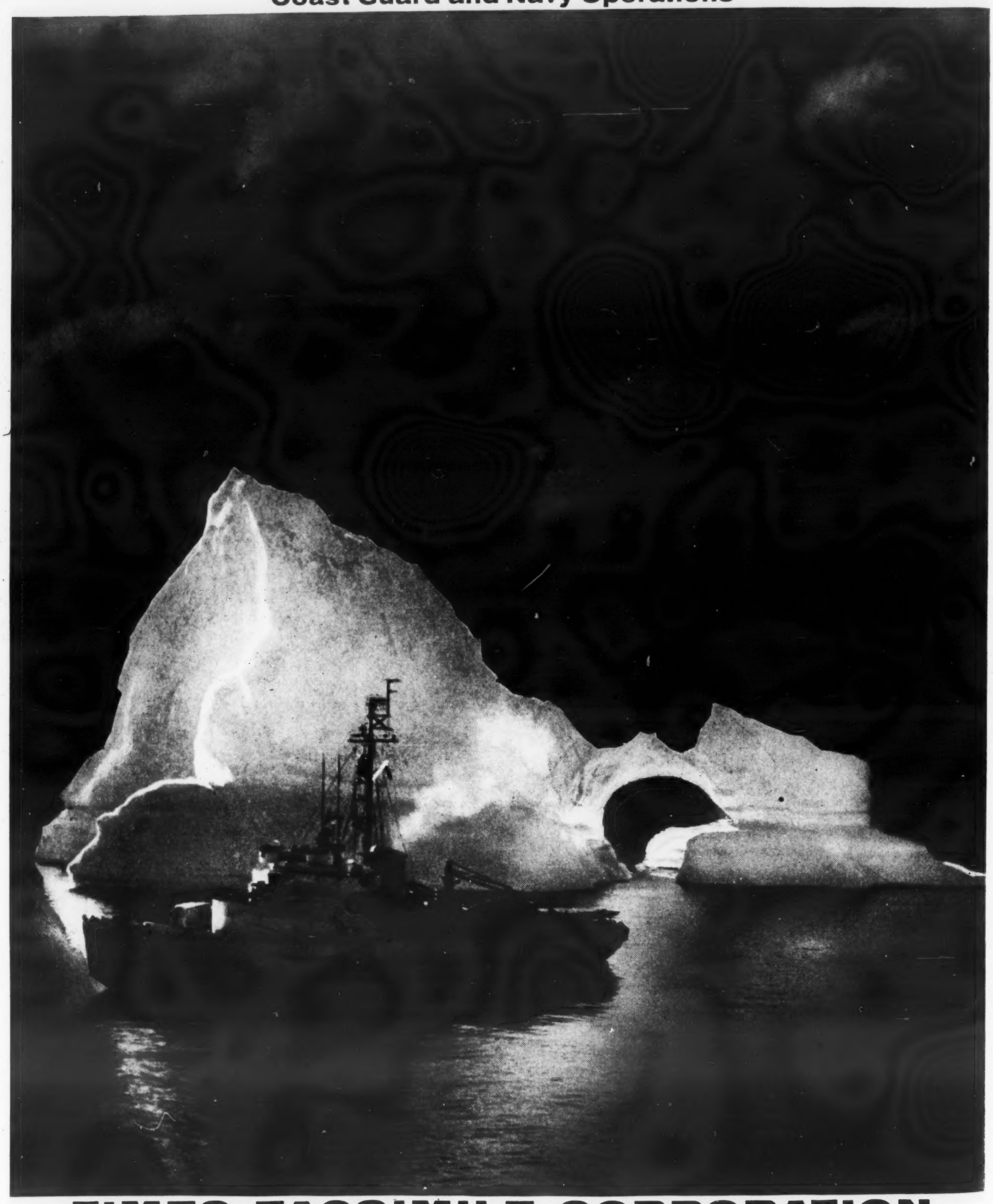
Today FACSIMILE is a must in Coast Guard and Navy Operations



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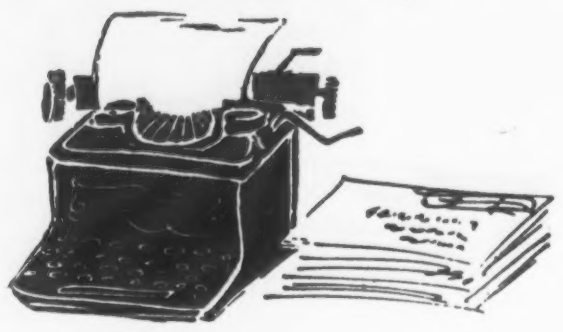

Our Readers Write

Dear Sir:

We read in the July-August "Memo to SIGNAL Readers" that shortages of skilled engineers and technicians will soon be solved by some mysterious television process. Shades of Euclid and Newton! This is greater than the discovery of atomic fission!

A nation of intellectuals—all brought about by the miracle of electronics. If someone has discovered a shortcut to education, it is the greatest invention ever to come. No more midnight sessions with Hooke's law, differential equations, English composition or valence tables. Every man a Steinmetz.

We have heard much of late about the volume of scientists and engineers turned out by the Soviet Union. Maybe they have beaten us to it!

What is needed for the moment, however, is a sort of common sense approach to the problem of trained technicians, to cover the interim period pending final development of ELM (Electronic Learning Machine).

The theoretical scientist can be forgotten for the purpose of this discussion. A look at a list of Nobel Prize winners suggests that no nation has a corner on this kind of talent. The trouble is that these great men give us the product of their genius to clutter and complicate our lives and wars. It seems that vehicles, airplanes, radar, radios, all require intelligent use and care. One need not know Maxwell's equations to repair a radar, but it is of help to know that they exist.

It is a fact that over ninety percent of the technicians responsible for the maintenance of technical equipment in the military services have had less than eight months of formal training in their field, and this includes those in immediate supervision. Moreover, this training is of a technical level below that of the average scientific course in European high schools.

Probably most readers of SIGNAL are not directly concerned with training technicians — any more than they might be concerned with the education of the physicians and surgeons of America. Nevertheless, it is comforting to know that if physical misfortune comes, his doctor will have had at least eight years of formal higher education. It is not so comforting to note that the young man and his sergeant who is responsible for the care of our complicated airplanes has had just a few months of high school level instruction.

A layman often gains the impression that a complicated piece of electronic gear is based upon a whole category of new ideas, hitherto unknown. As a matter of fact, the intelligent use and care of these devices requires a knowledge of ideas known to scientists a hundred years ago, but this knowledge cannot be gained in short-term training courses.

Our educators define an engineer as one capable of executing a finished design, based upon the laws of science—an applied scientist. This definition may not be so popular in the Soviet. In fact, the real secret weapon of the Soviet may be in the education of the masses which has resulted in a mass of trained technicians. A fellow with a fair knowledge of trigonometry will be in good position to understand the workings of a radar or landing gear, even if the trigonometry came between doses of Marx.

Brilliant scientists and designers are born that way. A good technician can be made from any individual with average talent and a little will power —provided he gets the education. What is needed in the military services is a program of college-level instruction for the senior career technician.

This technician will pay for his education by the savings in formerly wasted supplies, components, and mishandling, lost as a result of innocent ignorance. The man responsible for technical equipment cannot be trained —he must be educated, and this is an intellectual process lasting more than a few months. That is, of course, unless the Electronic Learning Machine changes all this, and I honestly do not think it will!

KEITH W. BOSE
Civilian Instructor, Electronics, USAF
Tokyo, Japan

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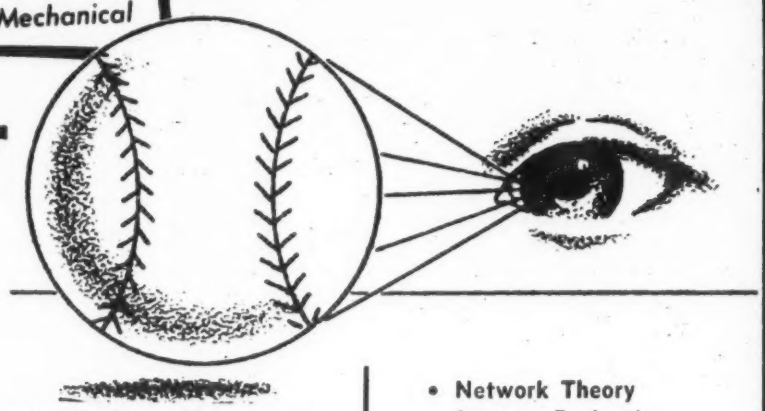
ENGINEERS
DESIGNERS-DRAFTSMEN
Electronic *Mechanical*

Keep Your Eye on the Ball



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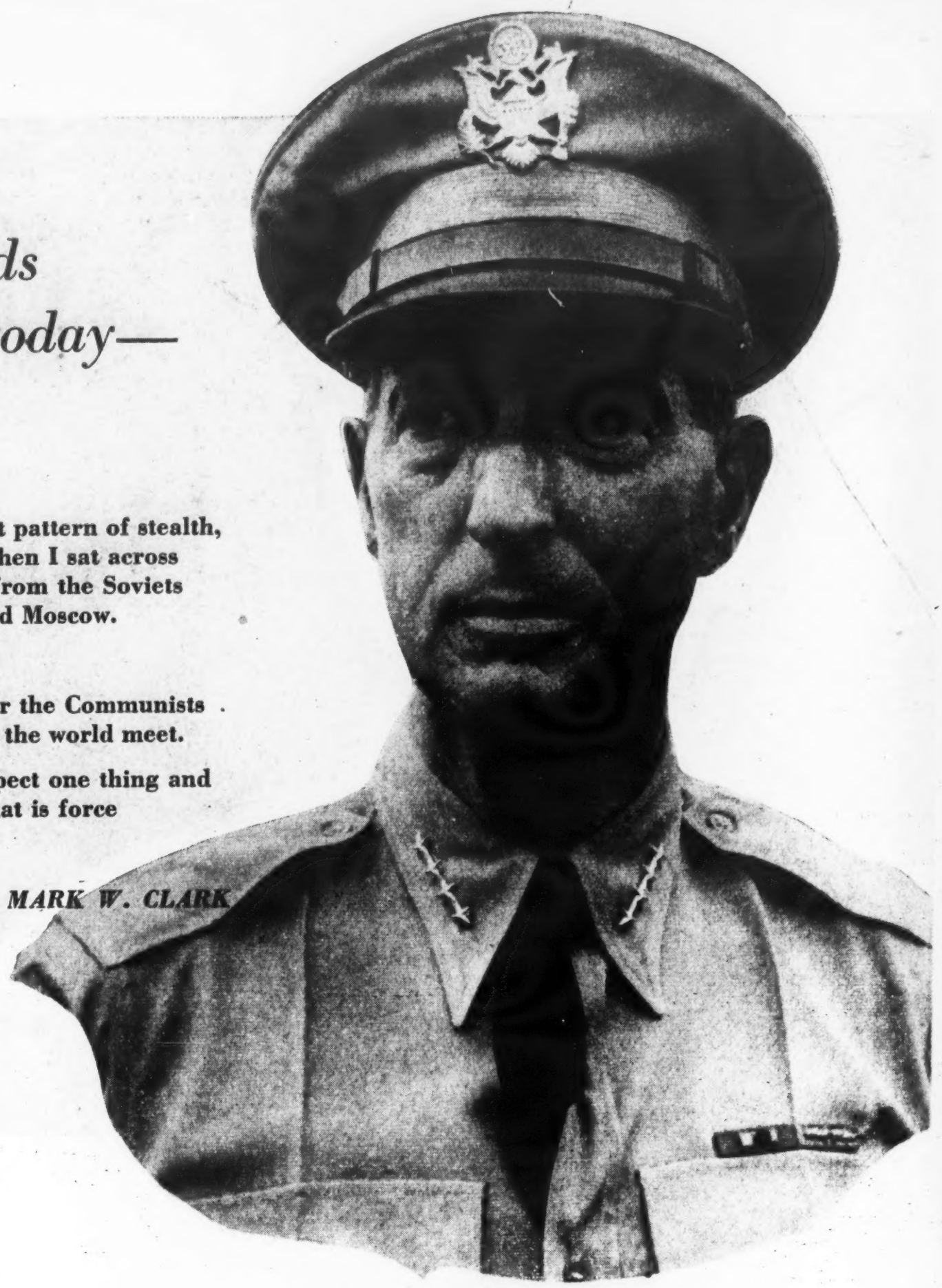

"I saw the Communist pattern of stealth, treachery and lying when I sat across the conference table from the Soviets in Vienna, London and Moscow.

"I saw it in Korea.

"It is present wherever the Communists and the free people of the world meet.

"The Communists respect one thing and one thing only, and that is force and determination."

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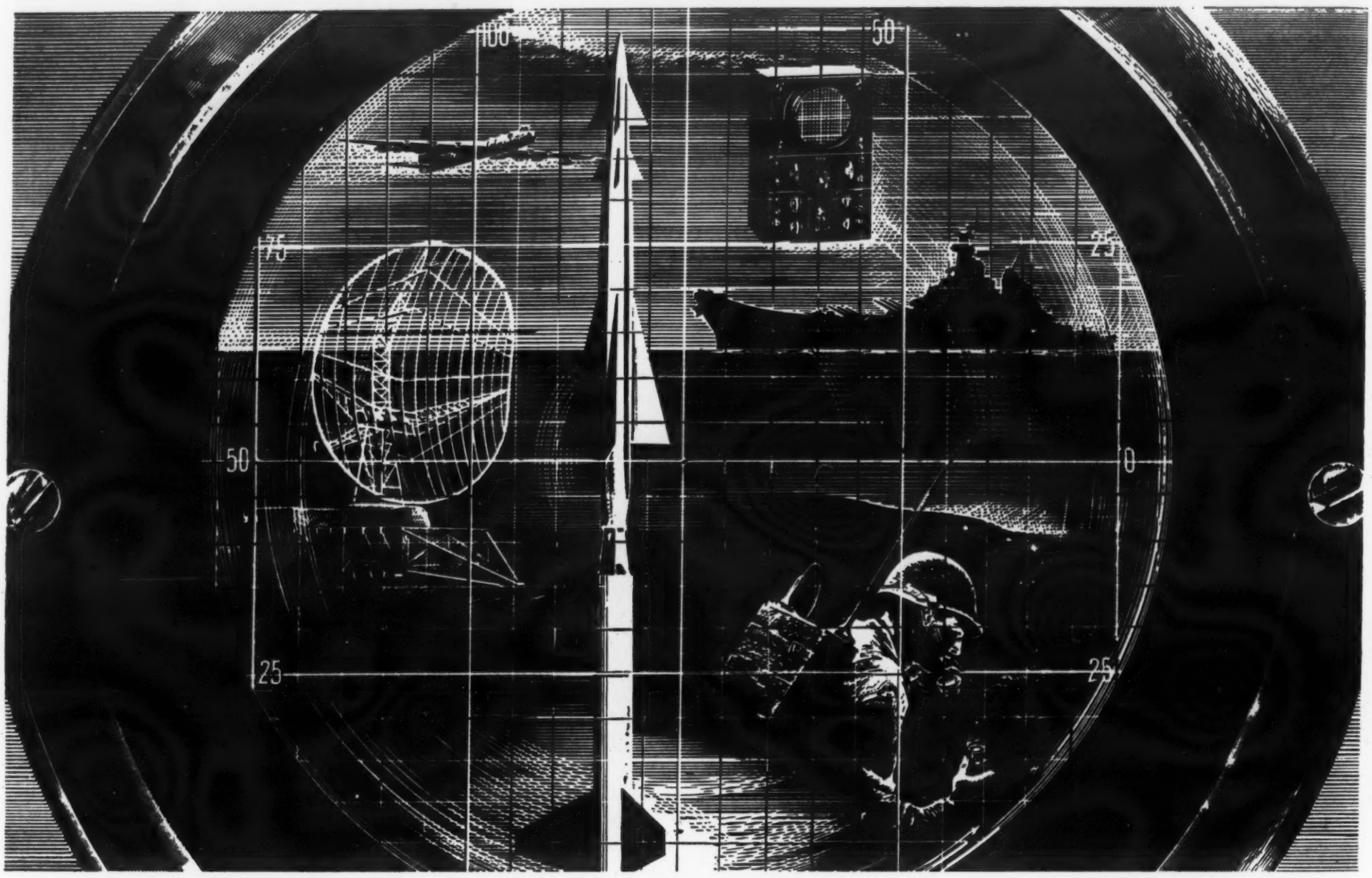

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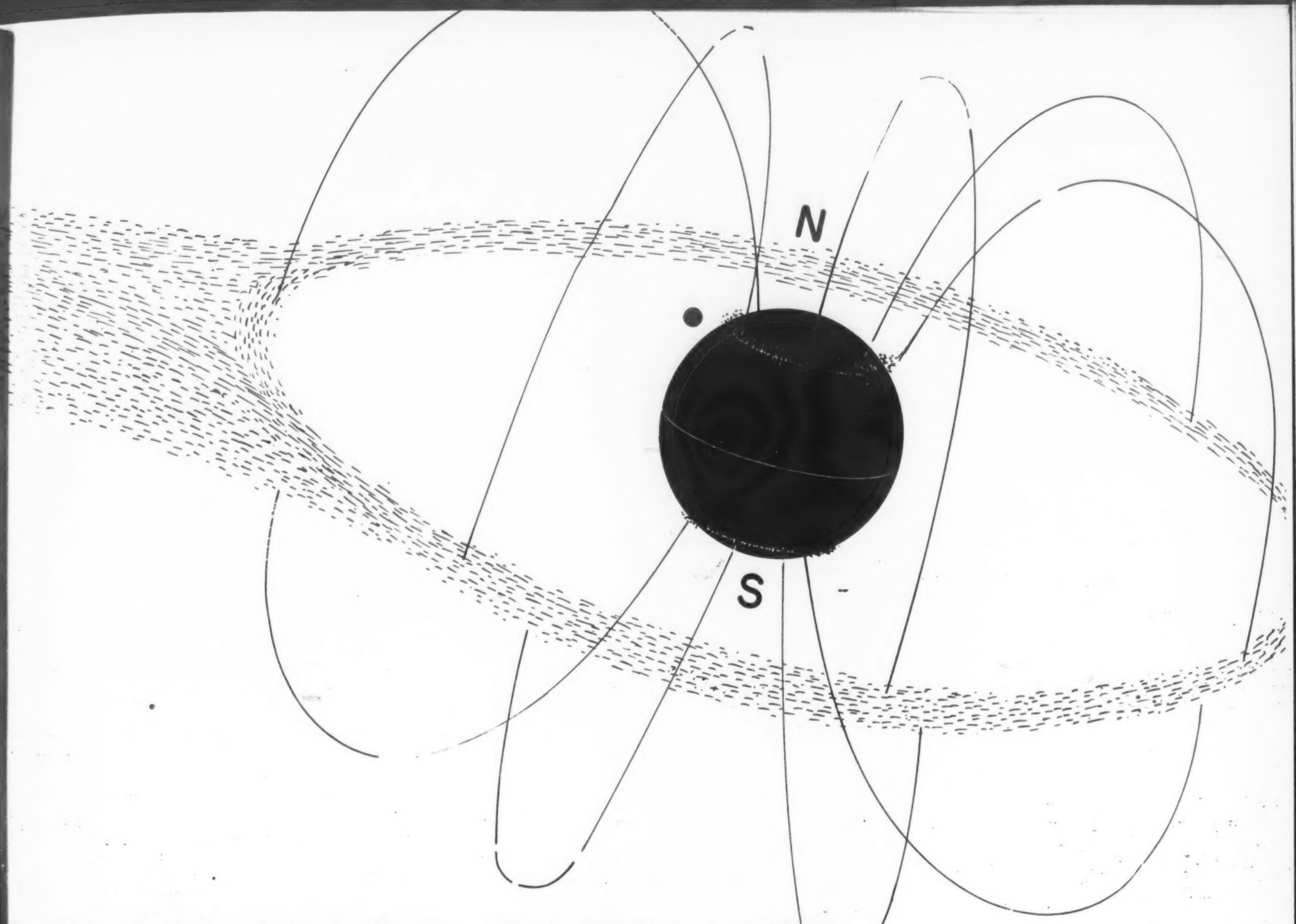


MAN-MADE SATELLITE
new tool for scientific research

by Dr. Homer E. Newell, Jr.
Executive Vice Chairman, Technical Panel on Rocketry
U. S. National Committee for International Geophysical Year

and Charles De Vore
Associate Editor, SIGNAL

SINCE THE WAR, THERE HAVE BEEN sighted and reported an untold number of UFO's — unidentified flying objects. Most of these have been identified later, often to the disbelief of the observer, as a common object, such as a large-size meteorological balloon. Enough interest has been sustained in them, however, to bring out the gregariousness that is characteristic of the *genus Americanus*, and UFO Clubs are still active today.

Some time during the next three years, there will appear in the skies an IFO—identified flying object—a man-made, earth-circling, unmanned satellite vehicle, or ESV (SIGNAL, September-October 1955, p. 74.) Opinions differ as to just how visible it will be, and it will probably be visible only a few minutes at a time, but many scientists agree that it should be visible through binoculars for those few minutes, a few hours before sunrise and after sunset.

The official announcement of the satellite project was made by the President's press secretary on July 29, 1955, in these words:

> "The President has approved plans by this country for going ahead with the launching of small, unmanned, earth-circling satellites as part of the United States' participation in the International Geophysical Year, which takes place between July, 1957, and December, 1958.
>
> "This program will, for the first time in history, enable scientists throughout the world to make sus-

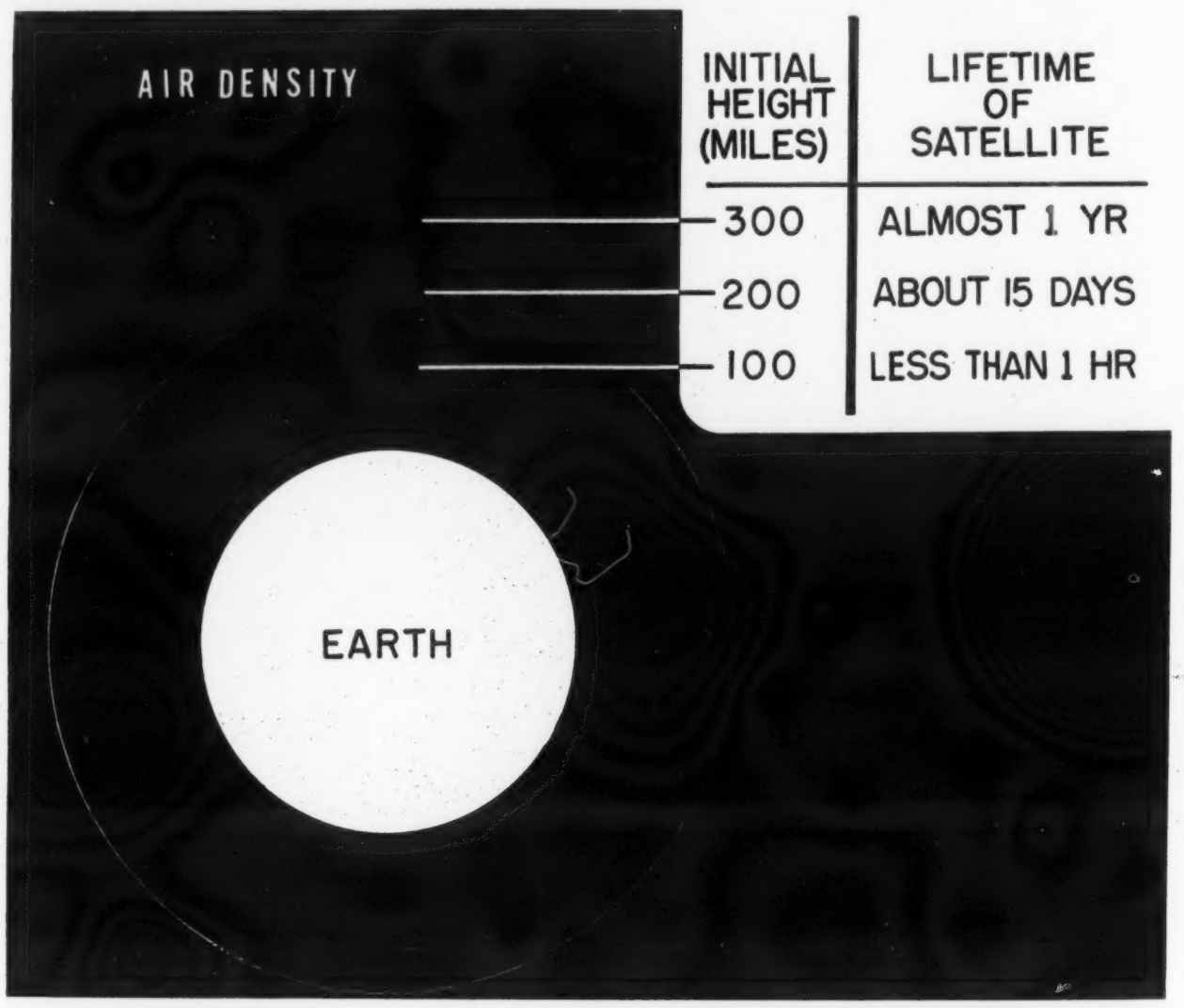
Proposed Satellite Application

One of the many anticipated applications of the satellites is to study electrical currents flowing in and beyond the ionosphere, as pictured above by Stormer Current Rings. Magnetometers and radio telemetering equipment would be used for the study, with results of better understanding of the aurora and the variations in earth's magnetic field, for better communications.

tained observations in the regions beyond the earth's atmosphere.

"The President expressed personal gratification that the American program will provide scientists of all nations this important and unique opportunity for the advancement of science."

Some technical details of the satellite proposal were furnished at the news conference by scientists from the National Academy of Sciences and the National Science Foundation. The Department of Defense, in a fact sheet, also revealed that it would participate in the program by "technical advice and assistance" from its scientists in the Army, Navy, and Air Force, such assistance to include rocket techniques and test facilities.



An important use of the satellite will be to determine the amount of air at satellite altitude. This is done by measuring the air drag on the satellite (acceleration=gravity—drag). Since air density is fundamental to the theory of ionosphere, air density information is needed for engineering design of high altitude or space flight vehicles.

A note of caution was added by the Defense Department: Although the purpose of the satellite program is to explore the upper atmosphere to obtain scientific data, many of the technical details involved in launching the satellite may remain classified, since they may be drawn from military development work.

However, it was promised, "All aspects of importance to scientists for scientific purposes, including the complete satellite itself, its orbit and its scientific instrumentation, will be released to the participating scientists of all nations on an unclassified basis."

Although details of the launching of the satellite may, therefore, remain classified, it appears obvious that a multi-stage rocket vehicle of some type will be necessary to get the satellite into its orbit around the earth. One guess, which assumes a three-stage vehicle, works something like this: The first rocket will start the entire assembly vertically on its flight, gradually being deflected as the vehicle ascends through the dense layers of the atmosphere, 50 to 60 miles above the earth. Then, its fuel expended, the first rocket drops off and the satellite is flown to its orbital height, perhaps 200 to 300 miles into the ionosphere. At this height, the second rocket drops off, and the third one accelerates the satellite itself, in a horizontal direction, to the required speed of some 18,000 miles per hour. When this last rocket drops off, the satellite continues in its orbit under its own momentum.

The question: What keeps the satellite in its orbit? is often asked. The answer can be simply given: the same thing that keeps the earth's only present satellite—the moon—from falling. A more technical explanation is that the centrifugal force which the satellite has obtained when it finally attains its high velocity and its orbital position just balances the gravitational pull of the earth. So long as this remains true, the satellite will continue to circle the globe, making a round trip perhaps every ninety minutes.

It is not expected to stay in the skies forever, however, even though its useful life has been estimated in terms of days, weeks, and even months. Thin as the atmosphere is some 200 to 300 miles above the earth, it still will effect a drag on a satellite, gradually remove energy from it, and bring it closer to the earth. As the satellite enters the denser atmosphere nearer the earth, it will heat up due to friction and is expected to burn up harmlessly in outer space like a "shooting star."

For further information about satellites, turn to Items of Interest, page 68, for an item on "Project Vanguard".

Another factor still unknown about the proposed satellite launching is the launching site. Since there are extensive rocket-launching facilities in the United States, it seems only logical that one of these would be utilized for the purpose.

As to the satellite's orbit, it might be launched to travel around the equator, which would make it easiest to track by theodolite, radio, or radar. It might be launched to pass over the poles; scientists would prefer this for study of such phenomena as the aurora and cosmic rays. It probably will be launched as much as possible in the direction the earth turns, so as to take advantage of the extra boost from Nature. And its orbit will probably be elliptical, rather than circular.

Undetermined Answers

Although it has been officially stated that details on the "complete satellite itself, including the instrumentation" will be made available, these details still are not definitely established. The Department of Defense fact sheet referred to the satellite as possibly not being any larger than a basketball. But the exact size—and shape—when determined will represent compromises.

Take the matter of size, for example. Obviously, one satellite is not going to be large enough to carry all the instruments which would be required to get all the information various scientists would like to obtain in this manner. The smaller the satellite, the easier it will be—relatively speaking—to get it into its orbit. On the other hand, the larger the satellite, the more instrumentation it can carry as payload for scientific studies and analysis.

An uninstrumented satellite, incidentally, would still have scientific value. From the standpoint of geodetics, for example, it might allow mappers to determine distances between points on the surface with greater accuracy than is currently

available. As the satellite crosses various points on the earth, its travel can be observed from ground tracking stations with great accuracy. The speed of its flight will be known. Therefore, the time of its flight between ground stations will provide an accurate measure of distance between those two points. Information obtained by triangulation techniques from an earth-circling satellite should thus improve present-day maps and navigation.

An uninstrumented satellite would also furnish new information on the density of the upper atmosphere. Thin as the atmosphere is at the 200-mile altitude talked about for the satellite, it still produces a drag on the satellite, causing its orbit to degenerate and gradually returning the satellite to earth. Measurement of this drag will reflect the density of the air at the satellite's altitude.

Such information will be valuable to the engineering design of future high-altitude flight vehicles. In addition, it should confirm—or correct—current theories on the ionosphere.

Assuming an instrumented satellite, what new information would it furnish to scientists? Some examples of the utility of an instrumented satellite are shown in the accompanying illustrations. In studying these, keep this important fact in mind: No single satellite that now seems feasible from an engineering standpoint could obtain all of this information. A compromise will have to be made, and making this compromise is only one of the many problems that confront the United States National Committee for the International Geophysical Year.

Table I

Path length miles	Repeater description	Power on earth	Repeater output*	Orientation must be better than
22,000	1000-ft sphere	10 mega-watts	0	No orientation
2,200	100-ft sphere	100 kw	0	No orientation
22,000	100-ft mirror	50 kw	0	18 miles 0 047 degree
22,000	10-ft antennas	100 watts	30 mw	360 miles 0 95 degree

Table I. Radio Relay Satellites (see text below). *Repeater Output. In the first three instances listed, the repeater referred to is of the passive type, that is, mere reflectors. In the last instance, the repeater is the active type, with powered transmitter and receiver.

Again, assuming an instrumented satellite, it is almost a certainty that electronic instruments will be included in the satellite itself, regardless of the experiment that is performed. Telemetering equipment will certainly be required to radio back to earth the scientific data that the other instruments obtain, since the satellite itself is likely to burn up on its return to earth. Perhaps one day it will be practicable to design a satellite that will return to the earth and can be recovered, but this still is some time in the future, in the opinion of most scientists.

Radio Relay Satellites

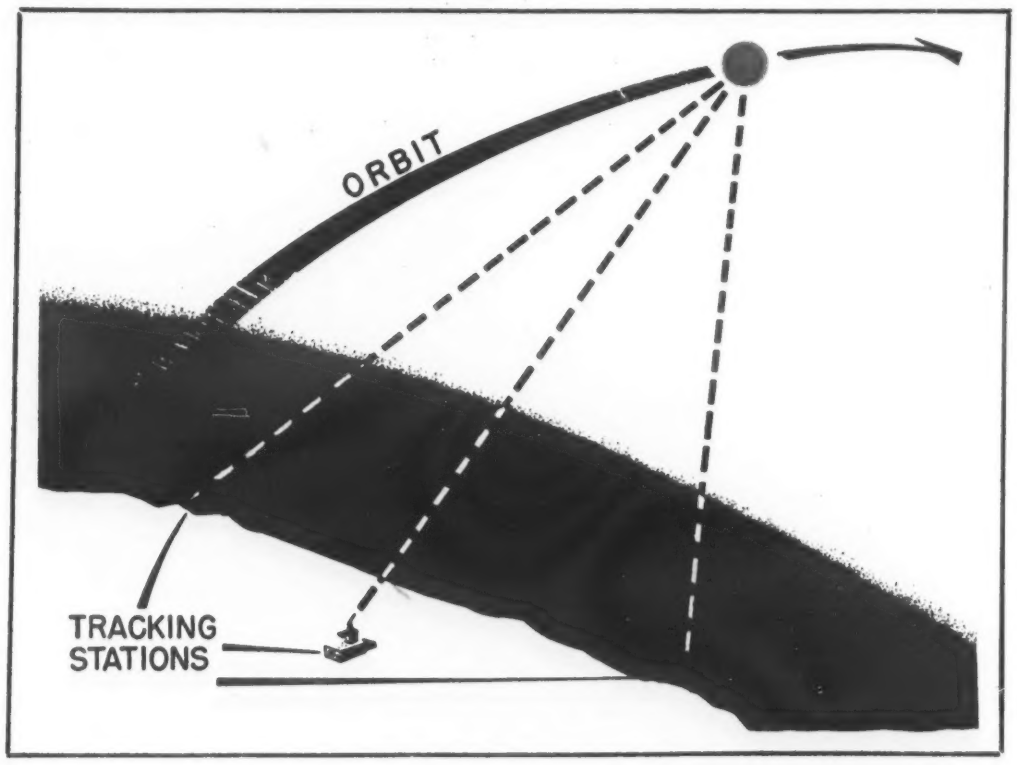
Still looking into the future, Dr. John R. Pierce, of the Bell Telephone Laboratories, has foreseen a use for satellite as radio relay stations, thus supplementing the now-crowded long-distance, and, particularly, transoceanic communication channels. The accompanying table summarizes some of his conclusions, as reported in *Jet Propulsion*, the official publication of the American Rocket Society. These data apply to a 5-mc video channel, provided by an 8-digit binary pulse code modulation system and a wave length of 10 cm. with 250 ft. diameter antennas on earth.

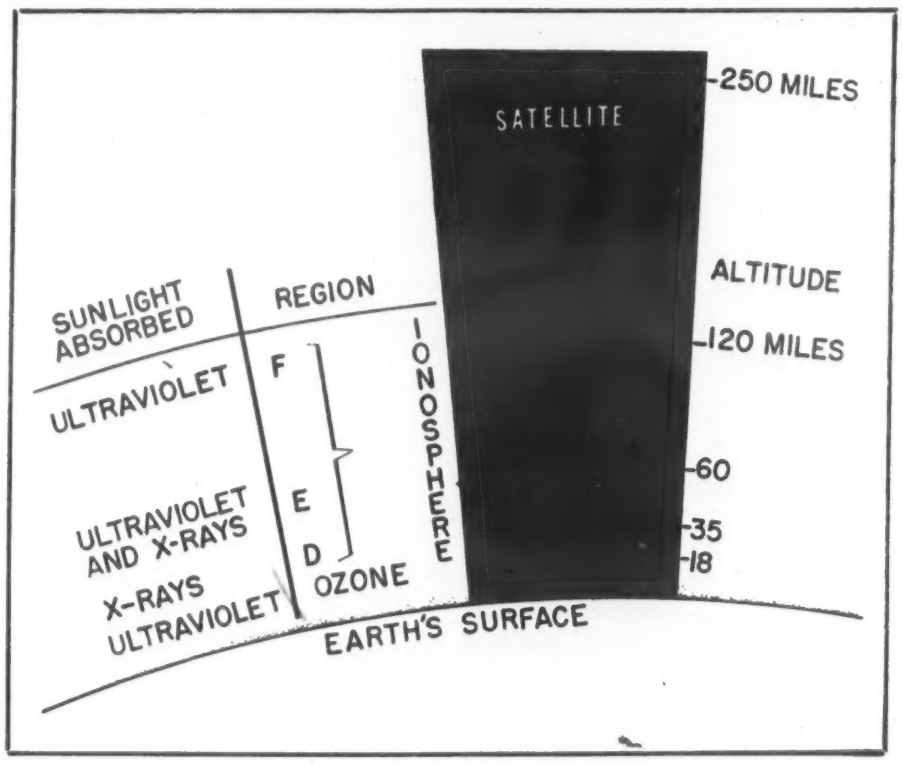
To quote Dr. Pierce: "Disregarding the feasibility of constructing and placing satellites, it seems reasonably possible to achieve broad-band transoceanic communication using satellite repeaters with any one of three general types of repeaters: spheres at low altitudes, or a plane reflector, or an active repeater in a 24-hr. orbit at an altitude of around 22,000 miles."

All of this speculation, however, goes well beyond the original suggestion of a satellite about the size of a basketball. This comparison between a basketball and a proposed satellite design, incidentally, has unfortunately been interpreted widely to indicate shape, as well as size. Shape, like size, will have to be a matter of compromise. This compromise may be more difficult to resolve, for it will need to be a compromise between the aerodynamicists who would naturally prefer a satellite which would be streamlined into the airframe of the rocket vehicle, and

(*Continued on page* 90)

The picture on the left below demonstrates a satellite's use for geodetic studies. By tracking and triangulation, the shape and dimensions of the earth, precise geographical coordinates and the distribution of crustal mass can be determined. This information would contribute to better navigation and mapping. On the right, the cut shows the use of a satellite to study solar ultraviolet and x-rays. This information would lead to a better understanding of the sun, ionosphere, weather and climate. By using photon counters and radio telemetering equipment, sunlight can be measured before it enters the atmosphere, and variations in ultraviolet and x-ray intensities caused by the activity in the sun can be determined.





The USS FORRESTAL moves from its berth in Norfolk. The smoke is not customary, but necessary when getting underway into open water.

from a talk
presented recently to
the Washington Chapter, AFCEA

a special report to AFCEA members on

The USS Forrestal

by Captain Rawson Bennett, USN
Assistant Chief for Electronics, Bureau of Ships

THE USS *Forrestal* IS SO BIG THAT EVEN A TEXAN could be truthful in speaking of her. The mind balks at thinking of a ship's flight deck being 1,036 feet long. But if you were to put the 5th Avenue entrance of the Empire State Building at the bow of the ship, and laid the building on its side, you could use the propellers to trim off the tip of the television antenna on the top of the tower.

Before going on to sketch in the *Forrestal* it might be profitable to consider why she is so big. *The answer is evolution, not revolution.*

The first recorded suggestion for a carrier generally like the *Forrestal* came from Admiral Marc Mitscher, the famed Commander of Task Force 58. The violent battles of the Central Pacific and Philippines showed the improvement in effectiveness of the 27,000-ton Essex Class carriers over the 20,000-ton Yorktown. The 45,000-ton Midways were already in construction, but Mitscher, with an eye to the future dreamed beyond them to something approximating the *Forrestal.*

The evolution also occurred in aircraft. World War II's heaviest carrier-based plane weighed about 18,000 lbs. at take off with full load. It landed at about 80 mph.

Today's carrier aircraft hit the deck at over 100 mph. The heaviest aircraft take off at about 75,000 lbs. and today's planes are jets, burning fuel at several times the rate of earlier designs.

So it happened that the ships grew, with a bigger and stronger flight deck, more fuel and ammunition stowage and more main engine power and more space and facilities for men, some 3,500 of them on the *Forrestal.*

A few of the statistics of construction might be interesting. The over 13,000 drawings laid end to end would

furnish a guide line along the highway from here to the other side of Salt Lake City, over 2,100 miles of blueprints. These prints called for 52,000 tons of structural steel, 2 million pounds of weld metal, about 200 miles of piping, nearly 300 miles of electric cable and many other things to fill over 1,700 freight cars.

There are about 4 acres of space on the flight deck. Running down the hangar deck would equal running down 2½ football fields.

The ship is subdivided into over 2,000 spaces. 1,240 of these are watertight compartments, and thereon hangs a tale. The Essex Class, of 27,000 tons, has 750 watertight compartments. These carriers fought some of the protracted actions of World War II. They fought submarines, surface ships and shore-based guns. They took bombs, torpedoes, gunfire and Kamikaze attack. Not one was lost.

In a word, the 750-compartment Essex Class are safe ships. The 1,100-compartment Midway Class are even better. And the *Forrestal* should be the best yet. The amount of damage a modern ship can take and still carry on is simply beyond the ordinary imagination.

It sounds innocuous to say that elevators are required to handle the planes. But each elevator calls for a well, or a hole. Now consider a long ship in a seaway as it encounters waves. First, it is supported on a wave. Then in between two waves, the bow rests on one and the stern on the next one. Since structurally, a ship is a girder, the girder must have strength to resist this constant bending of the waves. The Bureau, the David Taylor Model Basin, and the Bureau of Standards went into the problem together and finally came up with a solution. The flight deck, itself, was made the upper girder member and the openings were specially designed.

The size of the new planes boosted the height of the hangar spaces to 25 feet; with the large hangar area, this space posed problems to be solved. The result is a tremendous space for a ship. As an aside, I understand the Chief of the Bureau recently remarked that the *Forrestal hangar was the largest auditorium in the Navy.*

In the hull research, it was found that the brittleness of conventional steel would be a problem when some operating conditions hit such a sizeable hull. This problem was solved by specially treating the steel.

When the *Forrestal* first went to sea, you doubtless read of some troubles with main engine thrust bearings. The main engines of the *Forrestal* deliver well over 200,000 horsepower. Each propeller handles more power than has ever been attempted before. The answer to the thrust bearing problem? Just a little more lubrication. Despite the problems of hull and machinery it is worth noticing that she has less vibration than any large ship ever built before.

Electronics Becomes the Commonplace

Upon reaching the province of electronics a startling fact is apparent—the miracles of yesterday have become the commonplace today. We take for granted that the *Forrestal* has long range air search radars, fire control radars and radars which can be used for navigation.

It is less obvious that TACAN, the new air navigation system, will put continuous accurate hearing and distance data in front of the pilots up to 200 miles from the carrier, for them to come home on. Closer in, Carrier Controlled Approach, the sea-going counterpart of Ground Controlled Approach, can be used to bring the planes right up to the touch-down point.

This is the first carrier to have the aerologist's new friend, a radio sounding device which automatically tracks the meterological balloon-borne transmitter aloft, computing wind velocities and directions in the upper air while also recording humidity and temperature.

In addition to radar information, the navigator has loran data, echo soundings from the bottom and direction finder bearings to aid him.

The communication officer obviously can call upon very extensive voice, and CW equipment. He can transmit and receive facsimile. Present day extensive use of teletype is not so obvious. Five transmitting channels and nine receiving channels can be made available. Something like two dozen teletype machines are aboard, a part of them used for internal communications. An example of this last use would be the circuit sending data into the pilots' ready room where it is projected on a screen.

At first glance, one might overlook the UHF antennas, because they are mounted below the flight deck, at the four corners, so to speak. The 8 antennas work in pairs, each covering 360°. Several transmitters and receivers are coupled into each pair so that there are a large number of channels available. Most important, the range of reliable communications was vastly improved.

Outside communications are only a fraction of the communication problems aboard a large ship. Let us examine some of the *interior communications.* To provide communication with plane handlers and other personnel on the *Forrestal's* flight deck, a completely new type of sound system was needed to provide a sound level up to 110 decibels at any point on the deck. To achieve this over such an extensive area, the only feasible method was to employ a large number of speakers spaced around

Facts about the Forrestal

Size: World's largest warship. 59,000 tons light displacement. 70,000 tons fully loaded. Height (keel to top of mast) is equal to a 25 story building. Length of 1036 feet and width of 252 feet is equal to 5 city blocks in length and more than a city block in width. Area of flight deck nearly four acres.

Cost: $198,000,000.00.

Power: Develops 200,000 H.P. If turbines were coupled to generators, that amount of H.P. could produce the electricity for a city of 1,600,000.

Speed: More than 30 knots.

Materials used: 265,000 pieces of steel used. 52,000 tons (total) steel used. 200,000 rivets. 1,020 tons of aluminum. 2,000 tons weld metal used; if ¼" size, this weld metal would span the distance from Newport News to San Francisco. 180 miles of piping. 290 miles of electric cable. Blue prints used equal to pathway 30" wide and 2,100 miles long. Drawings used—13,500.

Rudders: Largest of three rudders weighs 45 tons and is equal to floor area of a two bedroom house.

Propellers: Two 4-blade and two 5-blade propellers each as high as a two story house.

Catapults: Four steam catapults can launch 32 planes in four minutes.

Hanger deck: Equal to 2½ full size football fields.

Air Conditioning: The 3,500 ton capacity system would completely air condition two Empire State Buildings. System is equal to melting 2,100,000 pounds of ice per day.

Crew: 3,500.

the deck. The requirements for these speakers were very rigorous. They had to emit large amounts of sound energy with an extremely wide distribution pattern. Also they had to provide high frequency response beyond that previously obtainable from horn-type loudspeakers. To complicate matters the speaker could be no more than six inches high. The final design employs 84 loudspeakers spaced equally around the deck. The amplifier system provides 6,000 watts of audio power from a bank of six 1,000-watt amplifier racks and a control rack.

This flight deck announcing system on the *Forrestal* provides for communication plus the transmission of alarms signalling collision, flight crash, and flight warning, through the most concentrated high powered audio system known to be in use today.

Telephone communication within the *Forrestal* is accomplished by both sound powered and dial telephone systems. In a departure from long Navy custom, no voice tubes are provided.

Specially Engineered Equipment

In the sound powered system, each circuit is designed to provide communication between a group of men to carry out a specific job. There are 24 switchboard, 34 switchbox and 55 string-type circuits, making a total of 113 individual circuits, to carry out ship control, engineering control, damage control, gunnery control, aviation control and many miscellaneous functions. These circuits require about 750 sound powered telephone headsets and 500 sound powered telephone handsets.

Amplifiers, designed specifically for use with sound powered telephone transmitters, are provided in 20 locations where ambient noise levels make reception difficult. Typical locations are the 5"/54 anti-aircraft gun mounts and the engine room spaces. An amplifier control section provides for automatic muting of the loudspeaker when one of the headset transmitters is being used at the local station, and for fail-safe operation to revert to sound powered telephones in case of amplifier or power failure. These amplifiers have proved very effective in increasing intelligibility and receiver response level.

The *Forrestal* is equipped with a larger dial telephone system than has previously been installed in any U. S. Naval vessel. The dial telephone exchange is nominally a 400-line switchboard which has the capability of handling 60 simultaneous conversations. The system covers approximately 560 stations within the ship, the additional coverage being obtained by the use of two party lines for less important stations. Such parties are assigned different telephone numbers and have individual ringing. The system is similar to a commercial system but is improved in many ways for Naval use. The switchboard framework is of aluminum for weight savings, and the exchange is housed in eight cabinets for ready passage through doors and hatches. Each cabinet is shock mounted to improve vibration and high shock resistant characteristics. There is an emergency number which may be dialed from any station, providing automatic cut-through to the Officer-of-the-deck station to report an emergency. There is an executive-cut-in feature which may be given to important stations to provide cut-through to any station, whether busy or not. A "hunt-the-not-busy-line" feature is also provided for stations assigned more than one line.

Three types of improved telephone sets are used in the system. A desk set with provision for bolting in place, a bulkhead type and a splash-proof type for bulkhead mounting in locations exposed to the weather. Both bulkhead types are provided with red light dial illumination when the handset is "off the hook." (All telephones are provided with locking devices to keep the handset from coming off the hook under shock.)

When the ship is in port, shore calls from any telephone can be made through a cordless manual switchboard, equipped with eight shore-line trunks, and attended by an operator. In addition, shore lines are provided for three teletype land lines and for direct telephone lines to the most important offices.

Besides the systems mentioned, it is necessary to transmit general orders and information to the entire crew. This means that the audio announcing system must reach every manned space on the ship. The system employs over 1200 loudspeakers of standard Navy design. The system is controlled from strategically located microphone stations. At each of these stations, electronic signal generators can be cut in which transmit alarm signals throughout the ship. These alarms, which have priority over voice transmission, sound general quarters, warn of impending collision, of chemical attack and other emergencies.

The general announcing system is driven by a 1,000-watt amplifier with constant voltage sound distribution. Loudspeakers can be added to or removed from the system without affecting the impedance match of the system. While the design of this system is conventional, the size of the *Forrestal* called for an installation which is as large or larger than any known single controlled commercial system in use today.

* * *

In this brief special report I have tried to sketch in the ship for you, to give you some idea of the size of her, to convey to you some feeling for the problems that had to be solved in creating a useful ship. For she is a useful ship, a home away from home for the men who man her. a base for the 100-odd planes she carries anywhere on the seven seas.

I believe that to the average man in the street the big advantage that a carrier has as a mobile air base is meaningless. Let us look at one phase of the situation. There is an old recipe that starts off by stating "First, catch a rabbit." In an average situation, our carrier rabbit might be anywhere on a curved line as long as the distance between Washington and Chicago. Every three minutes she is moving two miles in an unpredictable direction. Finding the rabbit in the first place is a job for a lot of people and a lot of planes. Then hitting the rabbit is another job for a sizeable force.

Contrast this problem with the fixed base which can be zeroed in exactly at leisure from routine intelligence information. And some day before long a missile launcher will be permanently laid on this target, so that one need only to push a button to destroy it.

The mere existence of the *Forrestal* creates a substantial requirement for enemy planes and man power.

I refuse to speculate on the effects of a nuclear weapon on the *Forrestal*. When people start tossing nuclear devices around like confetti, it would be nice to be in the Central Rockies or the midst of the Australian desert. Short of such spots I'll take my chances with the *Forrestal!*

FURY ON THE TRAIL

Purposefully, as if on a rendezvous with doom—as indeed it is—the guided missile blasts its way through the long reaches of the sky. The roaring flame is its power, but the "eyes" and "brain" that guide and control it are electronics.

RCA has cooperated for years with the armed forces to develop guided missiles of ever-increasing accuracy and effectiveness . . . the same mutual effort that is constantly being applied to creating, designing, developing and producing complete electronic systems in this and other fields relating to national defense.

Engineering consultation available.
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Engineering Products Division, Camden, N. J.

RCA
GOVERNMENT DEPARTMENT
RADIO CORPORATION of AMERICA
ENGINEERING PRODUCTS DIVISION CAMDEN, N.J.

A LETTER FROM STATION CFAC,
CALGARY, ALBERTA

E. C. CONNOR
Technical Director
Broadcast Station CFAC
Calgary, Alberta

AN AMPEX FALLS —AND PROVES ITSELF!

An accidental fall really proved the ruggedness of one of our Ampex 600's. It had had to be located on a narrow shelf four feet above a cement floor in an industrial building. Despite precautions someone pulled on the microphone cable at precisely the wrong moment and the recorder landed on one corner on the floor. The Ampex continued to record, and to the surprise of all concerned, it was impossible to detect the spot on the tape where the machine had fallen off the shelf. The only damage to the recorder was a displaced hold-back tension spring.

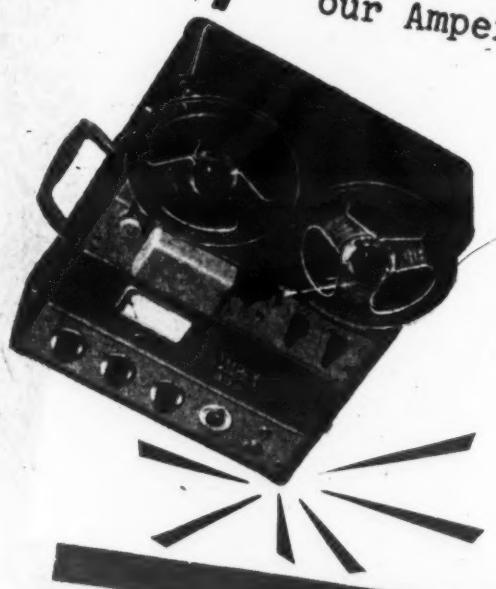
At present we have in service two Ampex 401's, two 403's, two 350's and two 600's. Required servicing has been much less than anticipated, and all are within specifications. To say that we are enthusiastic about the performance of our Ampex recorders could be considered an understatement.

Sincerely,

BROADCAST STATION CFAC

Earle C. Connor.

E. C. Connor
Technical Director



THE AMPEX 600 WAS DESIGNED BOTH FOR USE AND ABUSE

When the 600 was first developed, Ampex engineers performed a test similar to CFAC's accidental drop—not by accident, but quite intentionally. Also, the Ampex 600 was given running tests equivalent to an estimated 10 years of service. These are reasons why the price you pay for an Ampex buys both the finest performance available and the most hours of service per dollar.

AMPEX

For descriptive literature, write Dept. P-2304

SIGNATURE OF PERFECTION IN SOUND

934 Charter Street • Redwood City, California

ELECTRONICS

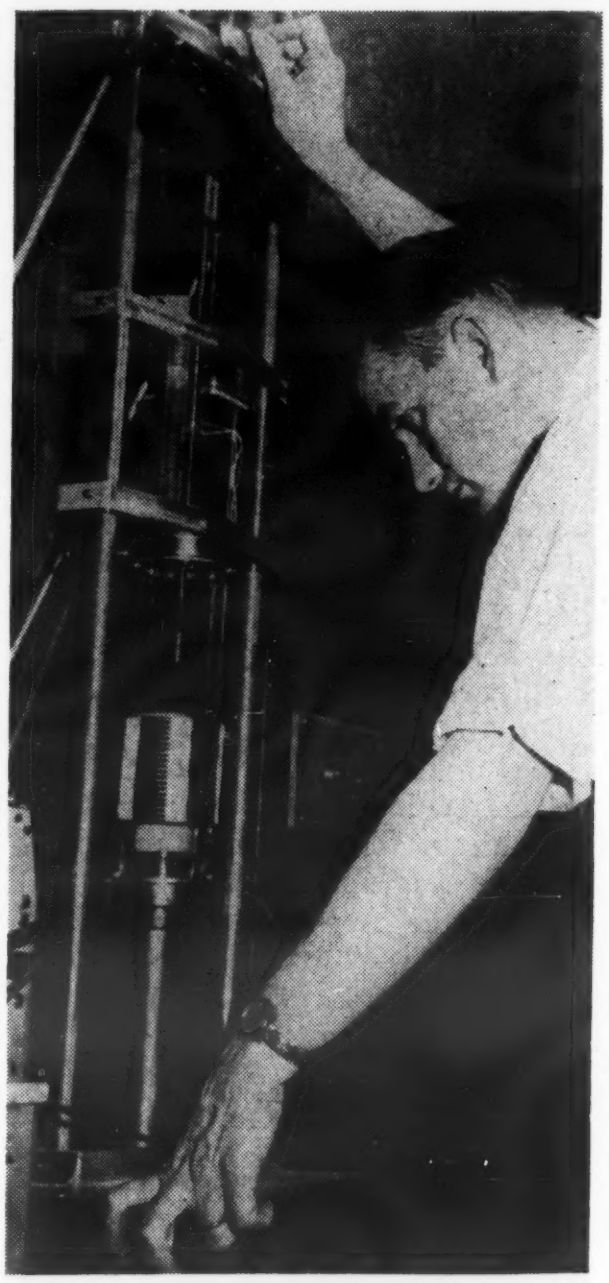
in the fuzing of modern weapons

by Robert L. Eichberg
Chief, Publications Branch
Diamond Ordnance Fuze Laboratories
Washington, D. C.

ELECTRONIC SCIENCE HAS DONE AS much to advance the art of war as did the invention of gunpowder. In the pre-gunpowder days, a soldier was safe when he was beyond bowshot; gunpowder made it possible to kill him at a greater distance.

In the days before electronic fuzing, a soldier was relatively safe when he was in a foxhole, unless a direct hit was scored upon him. If a bomb struck the ground and burst a short distance away, he was probably unhurt, since the fragments are projected upward. Electronic fuzing, which first made its appearance in World War II, made possible the accurate air burst, which causes a bomb to spray the ground with a lethal pattern of fragments.

More than a hundred years ago, the desirability of an electrically-fused air-burst shell was suggested by Lieutenant Henry Moor, USN, in a letter to President James Polk, dated May 10, 1846.*



An electronics scientist at the Diamond Fuze Ordnance Laboratory grows a germanium crystal for use in a development project.

Lieutenant Moor's letter is too long to quote in its entirety, but the following excerpts will indicate his trend of thought. ". . . it is not necessary for the electric shell, like other shot and shells, to strike the object in order to produce its effects; it is only necessary to pass over it or near it when the explosion is to be effected, and the enormous volume and intensity of the flame will destroy and set fire to every thing in its vicinity. . . The explosion near the deck of a ship would instantly disable her and set her in a blaze; she could not without similar weapons, and defences altogether different from any in use, maintain the contest for a moment . . . and even if (the shell) should strike the water near the ship, electricity would be equally available under water.

"The principal injury would not, as at present, be inflicted by striking the object and scattering the fragments of the shell, but the volcanic effects of the fire from the explosion would overwhelm everything in its

*Published in *Mechanics Magazine*, London, No. 1215, Nov. 1846, pp. 487-490, with following editorial comment: *We have received by the last arrivals from America the following remarkable letter. It is addressed to "His Excellency J. K. Polk, President of the United States," and marked "confidential," and a wish is expressed that the invention disclosed in it may "be kept as secret as possible," as it "would lose much of its value (to the United States) by its being adopted by other nations." As we happen, however, to owe no allegiance to Mr. President Polk, we do not hesitate to make it public, for the benefit of our own and of all nations. Ed. M. M.*

vicinity. I cannot too strongly insist on the fact, that against the action of the electric shell there is no protection for those attacked. The ship has no bulwarks to prevent the effects of the explosion as it passes over her decks, and all fortifications are built with reference to the lateral attack only, while overhead a much greater space is left without the slightest protection. The explosion of shells over this great extent of exposure, would immediately make any fortress untenable. . . Here by the aid of science, man holds the flying projectile still subject to his will, and is enabled to throw it harmless in its course over friends, if necessary, until it reaches the object selected for destruction. . ."

Lieutenant Moor proved that air bursts could be accomplished by series of tests at Governor's Island and Sandy Hook. The method he proposed and proved was use of an electric detonator for the shell, connected by 1,500 feet of wire to a control at the firing point. In those days, shells traveled about 100 fps (according to Lieutenant Moor), and it was possible for a man with 0.25 second reaction time to control the position of burst within 25 feet. All of five tests reported in his letter were successful.

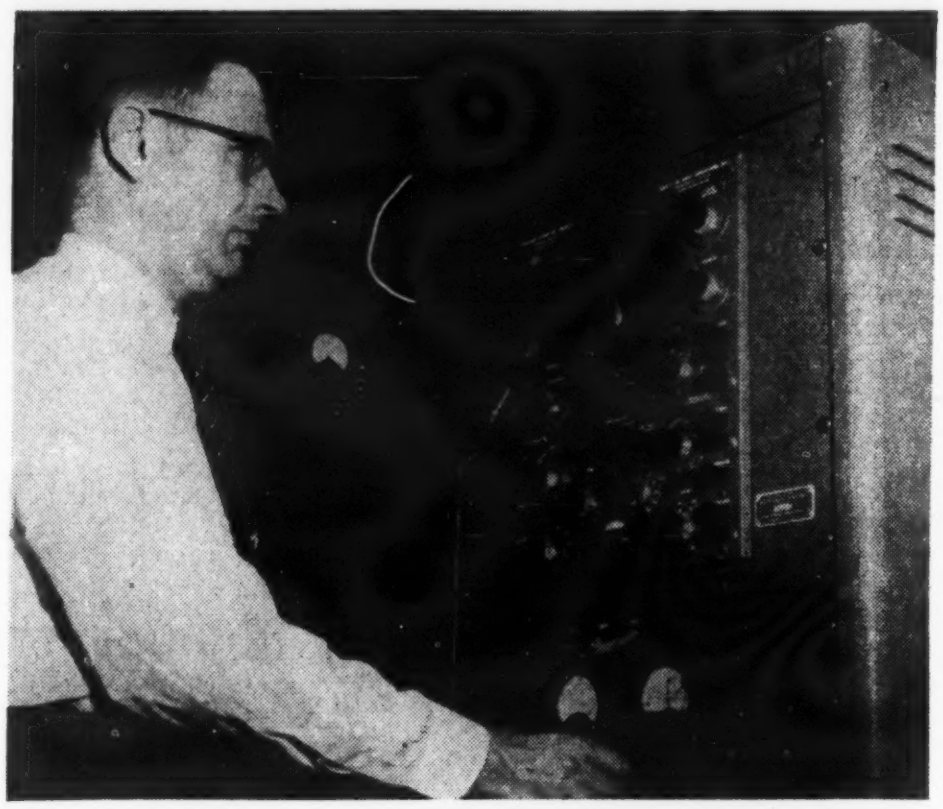
Beginning in World War I, Improvements in World War II

Although the need for airburst was recognized so long ago, the means for achieving it left something to be desired. A better method — use of mechanical time fuzes—was achieved in World War I, but it was not until World War II that electronics had progressed sufficiently to make possible the proximity fuze. The United States was the first nation to succeed in producing this efficient fuze, which senses the presence of a target and causes the missile to detonate when it is within lethal distance of the target.

During World War I, when aircraft first became a weapon and when radio was in its infancy, an antiaircraft defense was needed. The obvious defense was to shoot the craft down—or try to—with guns on the ground or machine guns in other airplanes. Ground-launched projectiles with contact fuzes would, of course, cause an antiaircraft projectile to burst if a direct hit were scored; but direct hits are hard to achieve on a fast, distant target which is taking evasive action, especially when the projectile launcher is manually directed. In order to avoid the necessity of making direct hits, settable time fuzes were used. If the time from launcher to target could be estimated with sufficient accuracy, a near burst would bring the target down. As a practical matter, a great number of missiles covering a time spread were fired in a hope that one of them would be near enough to the target to score a "kill" upon detonation.

By the beginning of World War II, aircraft had been improved tremendously; not only could they fly longer distances with heavier payloads, but they flew at higher altitudes and greater speeds. The fuzes of World War I were insufficiently effective against them.

A fuze was needed which would "know" when it was in sufficiently close *proximity* to the target to burst with optimum effect. A *proximity fuze* of this sort would cause a burst at a predetermined height above ground targets, and when approaching an aircraft would cause a burst when near enough to wreck the plane, even though its course was such that no direct hit would have been made.



Part of the engineering necessary for fuze development is the evaluation of a transistor on a characteristic-curve tracer. This is done here by an electronic systems research scientist.

Due to the high relative speeds which might exist between missile and target, instantaneous fuze action is required. The logical approach is through electronics.

When the Armed Forces decided to go ahead with a proximity fuze program in 1940, development of fuzes for *rotated* missiles, such as artillery shells, was assigned to Department of the Navy; the development for *non-rotated* missiles, such as bombs, rockets, and mortar shells, was assigned to what was then the War Department (now Department of the Army) which called upon the National Bureau of Standards for technical assistance. The principal personnel and facilities which engaged in this work became the nucleus of the Diamond Ordnance Fuze Laboratories when that installation was activated in September, 1953.

Two approaches, both electronic, were studied for application to non-rotated missiles. One was straightforward radio transmitter/receiver incorporating a bandpass filter in order to utilize the Doppler effect.* The other approach utilized a photoelectric cell to determine changes in illumination upon approach to a target, the output of the cell being analyzed and amplified to function the fuze.

In the radio-type fuze, a small transmitter generates a constant signal, which is radiated from a compact antenna. When this signal strikes the target (an aircraft, the earth, etc), a portion of it is reflected back to the antenna, from which it is fed into the receiver. Since the fuze and the target are in motion relative to each other, the Doppler effect exists, and the received signal differs in frequency from the transmitted signal. These two signals are combined and the resultant signal is passed through a filter and amplified; when this signal is of the correct frequency (to discriminate against harmonics) and amplitude, it causes the fuze to function, detonating the missile. The design of the antenna is such that the radiation pattern will approximate the frag-

(*Continued on page* 28)

*"Doppler-Fizeau effect. The apparent change in the frequency of light or sound observed when the source and the observer are in relative motion to one another." Merriam-Webster Unabridged Dictionary, 1952 ed.

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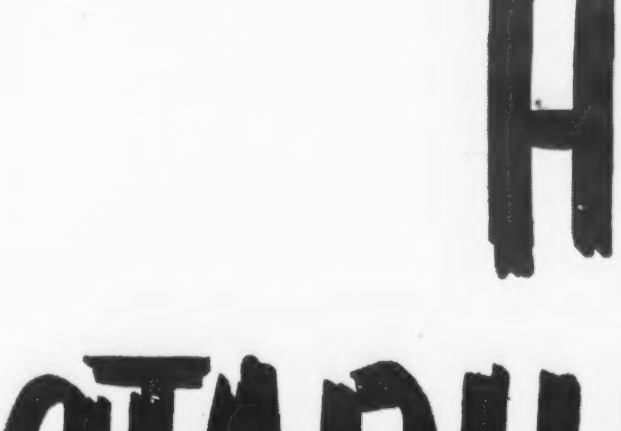

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mentation pattern of the missile and the electronic system is so designed that function will occur when the target is within the effective radius of the missile. Thus it is not necessary that the missile strike the target, nor that the time from launch to target encounter be known. If, however, the miss distance is too great for the fuze to function, a "self-destruct" circuit in the fuze will cause an anti-aircraft missile to destrov itself in mid-air so as to avoid danger to friendly ground forces. In bomb fuzes, impact detonation is provided in case of failure of the electronic system.

This is, of course, a highly simplified explanation of an early type of proximity fuze developed and used during World War II. Modern fuzes are far more complex, for they must contain provisions for rejecting natural or man-made interference, circuitry or mechanisms which will prevent them from operating until they have reached a specified safe distance from the launcher, features which will render them immune to the effects of moisture, temperature, and long storage. They must be small, since the space available to accommodate them is strictly limited, and must be inconceivably rugged to withstand not only the shocks of shipment, but also the acceleration of launching, which may be many thousands times the acceleration of gravity.

The radio transmitter/receiver, with filter, power supply, antenna, safety mechanism, and detonator are all contained in a casing about the size of a man's fist, and shaped to be ballistically compatible with the missile with which it is to be used. Design of the circuitry would be a problem even if standard parts could be used, but such parts are unsuitable because of their large size and lack of ruggedness.

Varying Requirements

The fields of electronics which must be utilized to reach these ends are extremely wide. To ensure the required ruggedness, for example, the components must be small and light; because of inertia effects, large, heavy components would tend to suffer internal damage, and to tear loose from wiring under heavy acceleration. It is, therefore, necessary to study all existing techniques for, say, printing circuits, and to devise new ones if present ones are not readily adaptable to the new uses.

Above, an engineer works at the control point of a model range used in evaluating the performance of electronic fuzes in scaled simulated flight against a target.

Production of resistors and capacitors by printing methods is a natural corollary. In first approaches to fuze design, miniature hearing-aid tubes were found to be a good first step—but only a first step since they were designed for the comparatively gentle treatment accorded to hearing aids. Further development was necessary to produce tubes which would not show fluctuations in output when subjected to the terrific vibration encountered in bombs which have reached terminal velocity, or in rockets in flight, or which would not be destroyed when fired under high accelerations.

Because of the limited space and the need for definite radiation patterns, extensive studies of antenna characteristics were necessary in order to provide optimum performance. Three of the antenna approaches have been: use of the missile as an antenna, resulting in an unbalanced dipole consisting of a nose-piece on the fuze insulated from the body of the missile; a short dipole antenna consisting of two stubs, one protruding from each side of the fuze nose and at right angles to the fuze axis; and a loop antenna in the nose of the fuze.

Power supplied to provide "A" and "B" voltages has taken several forms. Use has been made of standard zinc/carbon dry cells applied to the fuze immediately before its installation in the missile. Another approach was the use of generators driven by small windmills which were caused to rotate by the missile's travel through the air. Still another has been the use of reserve cells. Each has its advantages and disadvantages, but in all cases the power supplies must provide solutions to problems which are very nearly unique. They must operate at temperatures ranging from sub-arctic to super-tropical. The fuze must be capable of storage for a period of several years, and must then be ready for use with a minimum of servicing; none at all is best. The power supply must provide an accurate output within very close tolerances—but this output is required for only a few seconds, at most. Also, the supply must be absolutely dependable.

The circuitry must be similarly dependable, for a fuze costing only a few dollars may be mounted in a missile costing thousands of dollars, and the effectiveness of the missile can be no better than that of the fuze.

Economy Very Important

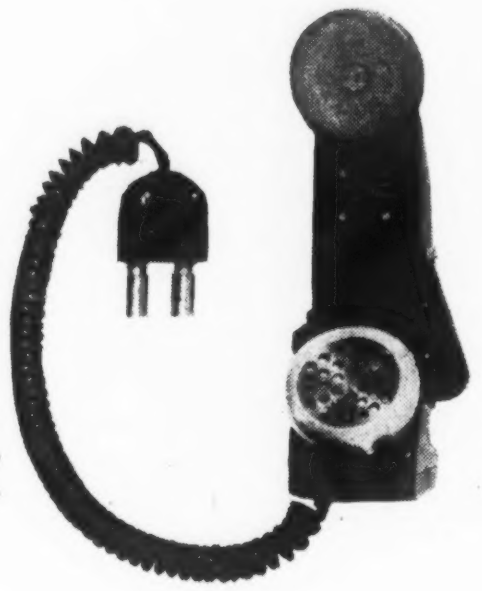
Despite the requirements of fuze reliability under a wide variety of conditions, of small size, and of extreme ruggedness, cost is a major factor, since fuzes are manufactured by the millions in times of war. The cheaper a munition is, the greater the quantity that can be produced; the higher the production, the better the chance of victory, which today is equal to survival.

Mention was made of a photoelectric fuze. This would be comparatively simple if it operated on the principle of a photometer, and merely functioned on a decrease in illumination. But such operation would

(*Continued on page* 90)

National Pneumatic Co., Inc.
and
Holtzer-Cabot
Divisions

The Old . . .
A ten-station automatic desk set developed by Holtzer-Cabot in 1897.



and the New . . .
a TA-1 (4) PT sound-powered telephone recently developed by Holtzer-Cabot.

by Robert Frost
Vice President

FEW ORGANIZATIONS HAVE SUPPLIED the Armed Forces for as long a period of time as the Holtzer-Cabot Divisions of National Pneumatic Co., Inc. of Boston, Massachusetts. The organization was originally the Holtzer-Cabot Electric Company which was founded in 1875 by the late Charles W. Holtzer, an electrical engineer who manufactured some of the parts used on the first telephone made by Alexander Graham Bell. This company developed and produced such diverse products as magneto ringers, telephones, inter-communicating systems, paging systems, and fractional and sub-fractional motors designed to customer specifications. In 1949, the company merged with National Pneumatic Co., Inc. of Rahway, New Jersey, a leading manufacturer of door operating and safety equipment for the transit industry, and a prime contractor for the Armed Forces.

Today, the two organizations form a company of more than 1,000 employees, including an engineering staff of 75. There are offices in New York, Chicago, Cleveland, Los Angeles, Philadelphia and Washington.

The plant and executive office is located in Boston in a six-story building which occupies 250,000 square feet. This building houses an extensive array of equipment, including assembly lines, precision cutting machines, grinders, punch presses and a highly specialized coil department. The engineering, research and development facilities are located in a separate, two-story building of 45,000 square feet, containing extensive electrical and mechanical testing and chemical analysis equipment.

The Holtzer-Cabot Divisions developed and now manufacture the only hand generator (G-42/PT) approved for use with Signal Corps field telephones and switchboards. In addition to developing the TA-1 sound power telephone, they make ringing machines, ringing dynamotors (TA 167-TA 169), and supply the motors for the high-speed teleprinters manufactured by Teletype Corporation for the Signal Corps.

For the Air Force, Holtzer-Cabot has just completed a development project on aircraft inverters. They are in production on a DC servomotor used in the fire control systems of jet bombers. This division is also engaged in classified projects of prime importance.

Working with the Armed Forces is not new at Holtzer-Cabot. They have worked closely with the Army and the Navy for almost half a century. In those 50 years, they have participated in some of the most important events in the history of communications.

Back in 1906, the Holtzer-Cabot Electric Company supplied the telephone equipment in the fleet which President Theodore Roosevelt sent around the world. This equipment was used in the fire control systems to provide communications between the central station, tops or fire control masts, gun turrets and torpedo

rooms. The telephones consisted of double-head receivers and breast transmitters, like those used by switchboard operators today.

Aircraft Radio in 1912

Six years later, the company participated in the first generator-powered wireless communications between air and ground. An engineer who is still with the company, Mr. Vernon Durbin, Associate Director of Engineering and holder and co-holder of twenty-nine patents, had a hand in this achievement. The U. S. Army Signal Corps, of which the Air Corps was then a component, commissioned Holtzer-Cabot to build a generator to power a radio transmitter for use in an airplane. The generator weighed 25 lbs. and was capable of delivering 500 cycles and 250 watts. It was the first generator ever to supply power for "wireless" in an airplane. The transmitter was a "quenched gap transmitter."

"My job was to install the set in one of the Wright brothers' planes at College Park, Maryland," Mr. Durbin recalls. "The first attempt was a failure. In connecting the generator, we rigged up a chain and sprocket system that weighed more than the generator. The result was that the combined weight of the generator, transmitter and all the connections proved so heavy the plane couldn't get off the ground."

A simpler system was then devised which the pilot could operate by pressing his knee against a switch whenever he wanted to transmit. This method proved satisfactory, and the occasion marked the first generator-operated wireless communication between air and ground. In fact, the transmitter powered by the Holtzer-Cabot generator could transmit a distance of fifty miles—which was the limit the U. S. Army would allow the plane to fly! It might be said that the 400-cycle generators used so extensively on aircraft today are descendents of this original 500-cycle generator.

Above is a drawing of the Holtzer-Cabot factory in Boston in 1885.

Through the years, Holtzer-Cabot introduced many other devices specifically for the Armed Services. These included: a high impedance headset (devised about 1914 for "wireless" communication), the first hand generator ever to power a portable wireless set, and a gyroscope motor-generator set, manufactured for the Sperry Gyroscope Company for use on U. S. Navy ships.

During World War II, Holtzer-Cabot played a vital role in equipping the Armed Forces. The company originated and produced a major portion of aircraft inverters, improved and manufactured a large portion of Army field telephone sets, electric motors for gunfire control, and instrument motors for a wide variety of uses.

Holtzer-Cabot has compiled an enviable record in designing and producing signal products for the civilian world. It was a pioneer in making and selling annunciators, underdome bells and buzzers, paging systems, in-and-out register systems, elapsed time recorders, phone-call systems and also fire alarm systems of both manual and automatic types. These units served such purposes as summoning personnel, giving alarms and timing nurses' calls, in hospitals, schools, restaurants, hotels, industrial plants, offices and municipal buildings. Many of them are still in use today.

A view of a section of the Development Laboratory at the Holtzer-Cabot plant in Boston

Firsts in Generators

About 1900, Holtzer-Cabot invented the first permanent-magnet power generator for ringing telephone bells. This was the forerunner of today's Holtzer-Cabot multi-frequency, harmonic, synchromonic and decimonic ringing motor-generator sets. These sets are characterized by extremely dependable performance and have been widely installed throughout the nation as more and more communities "go dial with Holtzer-Cabot."

Holtzer-Cabot was among the first companies to produce single-phase, fractional horsepower motors. It also produced the first generators of the

The present Holtzer-Cabot plant at 125 Amory Street in Boston.

"noiseless," type for charging batteries in telephone offices without causing objectionable noises on the telephone lines.

The company pioneered in condenser induction motors. Between 1930 and 1936, six patents on this type of motor were issued to Mr. C. L. Kennedy, Chief Engineer of Motors. Several other motor manufacturers were licensed under these patents. Holtzer-Cabot originated the sub-fractional synchronous motor with gear train for chart drive and instrument applications.

National Pneumatic

National Pneumatic Co., Inc. also has a long, interesting history. Founded more than 50 years ago, it specializes in door operating equipment which is used by almost all the major railway, bus and subway systems in the world.

The first hand-operated door mechanism for street cars was a National Pneumatic product. With this mechanism, the operator could open and close the door and collect fares without leaving his station.

This product, now obsolete, was the forerunner of a series of special devices and systems developed for the transit industry. The list is is lengthy: the first air-operated and air-controlled doors (1904); the sensitive door edge, which reverses the door's direction if it strikes a passenger (1915); treadle-operated, passenger-controlled doors (1919); the first turnstiles and fare boxes (1920); brake interlock — keeps brakes applied until doors are closed (1920); power interlock (1925); and the accelerator interlock (1925).

In 1920, this company gave the transit industry the first multiple unit door operator. With this system, two conductors can operate all the doors on a long train. Previously, one conductor could handle only the doors in two adjoining cars.

Vacuum- and hydraulic-operated doors were developed in 1929 and electrically-operated doors in 1937. In 1945, the company brought out the automatic end door operators now so widely used on railway cars.

In recent years, National Pneumatic has produced automatic door operators for industrial and commercial buildings. One type, Supermatic, is used to open outside doors. The other, Economatic, is used to open warehouse doors and doors located in the interiors of buildings. Some of the latter have been installed in Veterans Administration hospitals. The company also makes automatic door operators for use in hazardous areas, a number of which are operating in arsenals and munitions dumps.

During World War II, National Pneumatic Co., Inc. was a prime contractor, producing large quantities of 37mm guns for light tanks and aircraft, feeder mechanisms, and 37mm and Oerlikon shells. It also manufactured hydraulic airplane struts and numerous other items.

Whatever the future brings, National Pneumatic Co., Inc. and Holtzer-Cabot Divisions are well prepared to serve the nation. In addition to its present commitments to the Armed Forces, the company is committed to the Industrial Mobilization Planning Program.

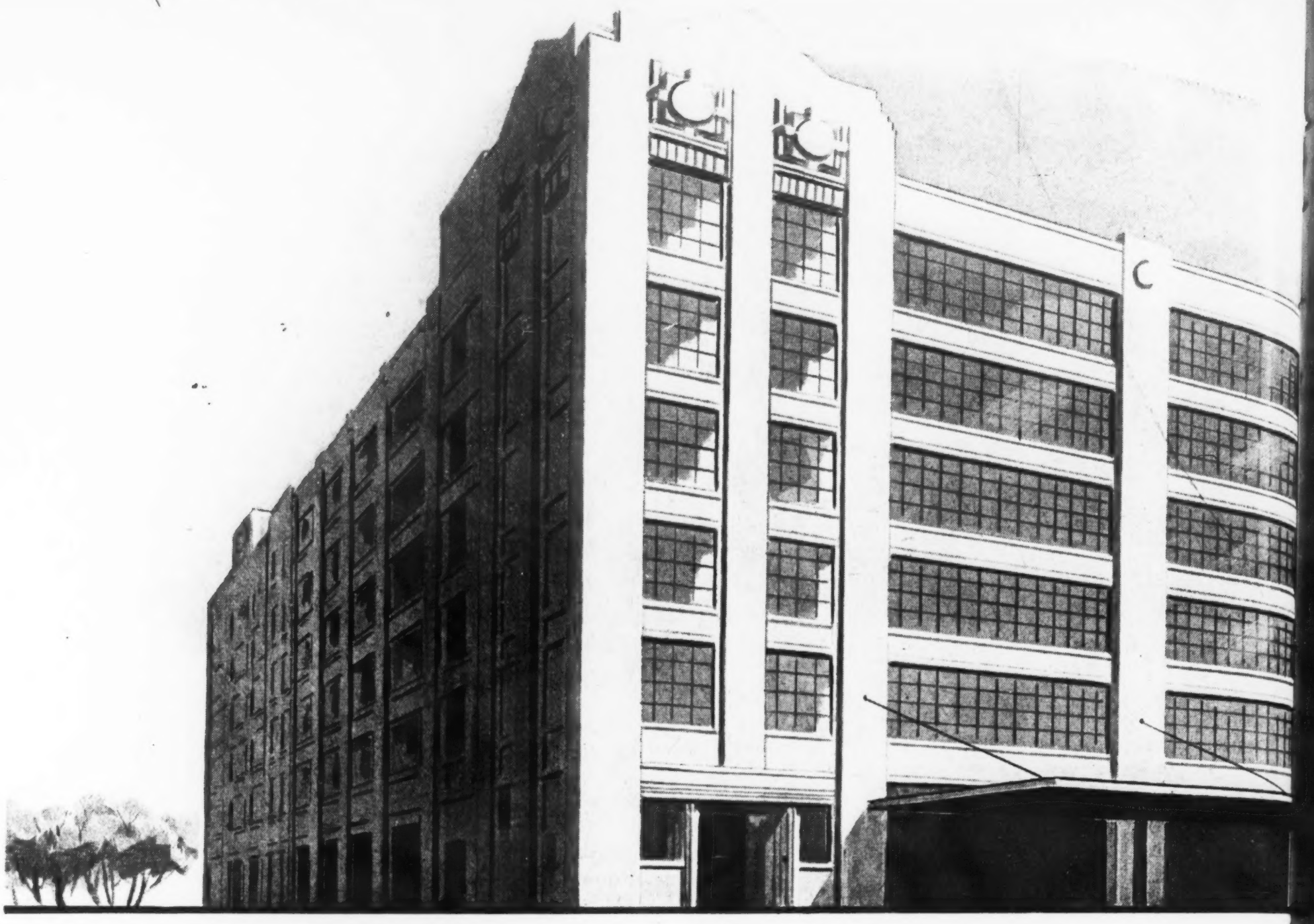
Currently, production is directed toward civilian industrial needs. The company supplies and works with most of America's largest industries, a number of which have been clients for many years. The list is impressive: Western Electric, American Car & Foundry, Bell Telephone, Allis-Chalmers, Automatic Electric, Kellogg Switchboard, Stromberg-Carlson, Pullman, IBM, Leeds & Northrup, Teletype, General Motors, Western Union, Federal Telephone & Radio, Raytheon, RCA, Westinghouse, Taylor Instrument, American Optical, Eastman Kodak, Link, General Electric and many others.

Company Personnel

The company is well staffed with experienced personnel and is ably led. Charles Frost is Chairman of the Board; John Newkirk, Vice Chairman, and Richard H. Frost, President. Harvey J. Finison is the Executive Vice President; Robert Frost, Vice President for Marketing,

(*Continued on page* 90)

A section of the area in which the assembly of hand generators for the Signal Corps is done.



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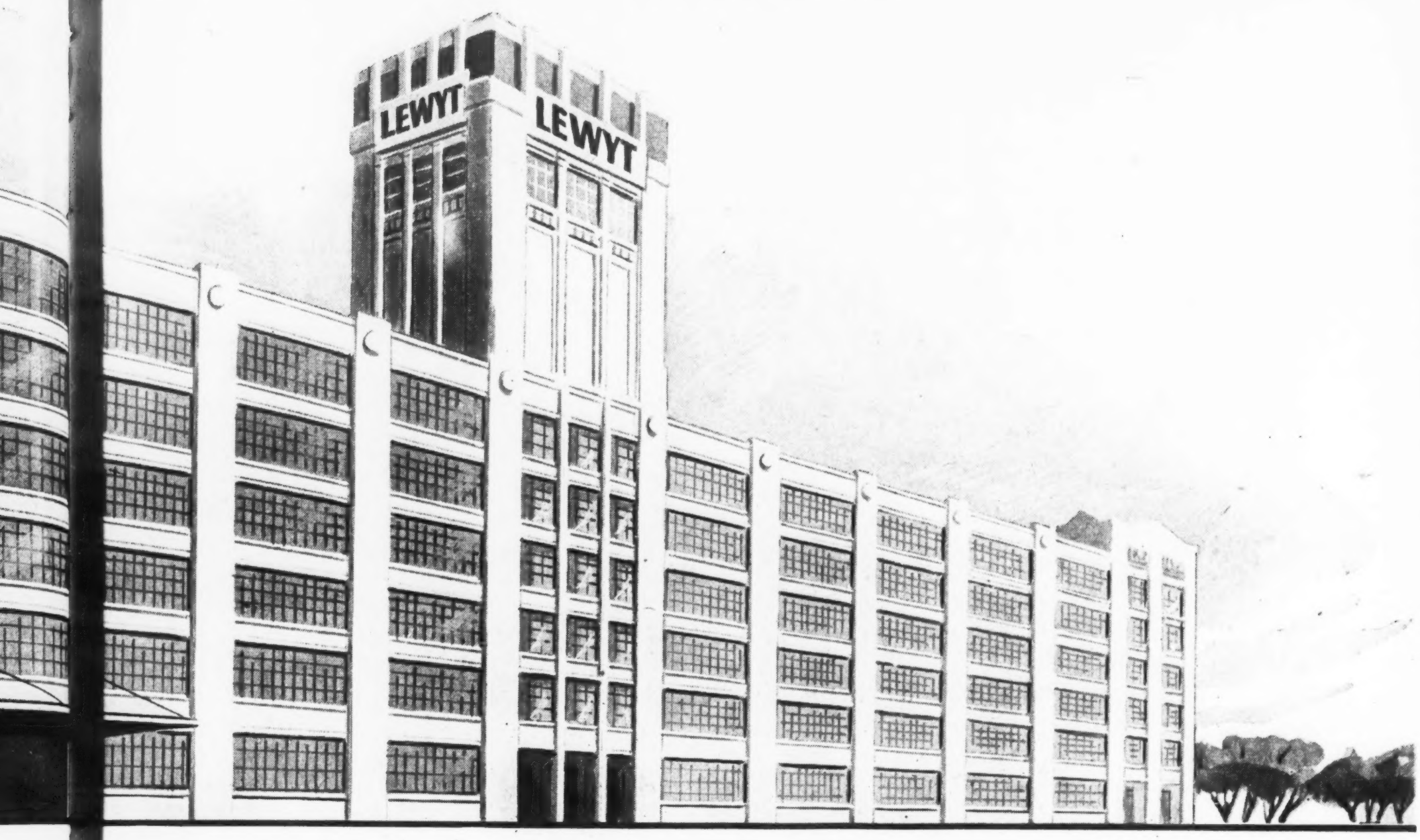

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LEWYT

Research, Development and Production of Electronic Equipment

Far East Signals

Another aspect of global communications is described in this story about current radio and electronics operations in Japan.

AS ONE RECENTLY RETURNED FROM a tour of the land of kimono and Geisha, I was most impressed with the many changes found there since 1933, the last time I passed through Japan.

The Japanese, always communications minded, are going in for United States electronics in a big way. Television is spreading rapidly in areas around Tokyo and Osaka, and American sets can be used after slight modifications have been made. Although the standard voltage of 100 volts, 50 cycles may be stepped up by transformers, most electrical lines are overloaded, the voltage going down to as low as 65 volts in the evening.

Even though I could not understand Japanese, many of the quiz programs, baseball games and Sumo wrestling matches were just as entertaining, or even more so, than if we had understood every word.

In the field of radio broadcasting there are at least 3 Japanese networks, including the official government one, which broadcast soap operas in Japanese, just the same as we do in English. *Of course, each house bears a metal tag indicating that the occupant thereof has paid his taxes for the year to permit him to operate his broadcast receiver.*

When it came time for me to install a telephone in my private rental, I found that for the mere sum of the equivalent of sixty-six dollars, a new Japanese-made magneto type desk phone was forthcoming, together with two Daniels wet cell batteries in a handsome oak box on the floor.

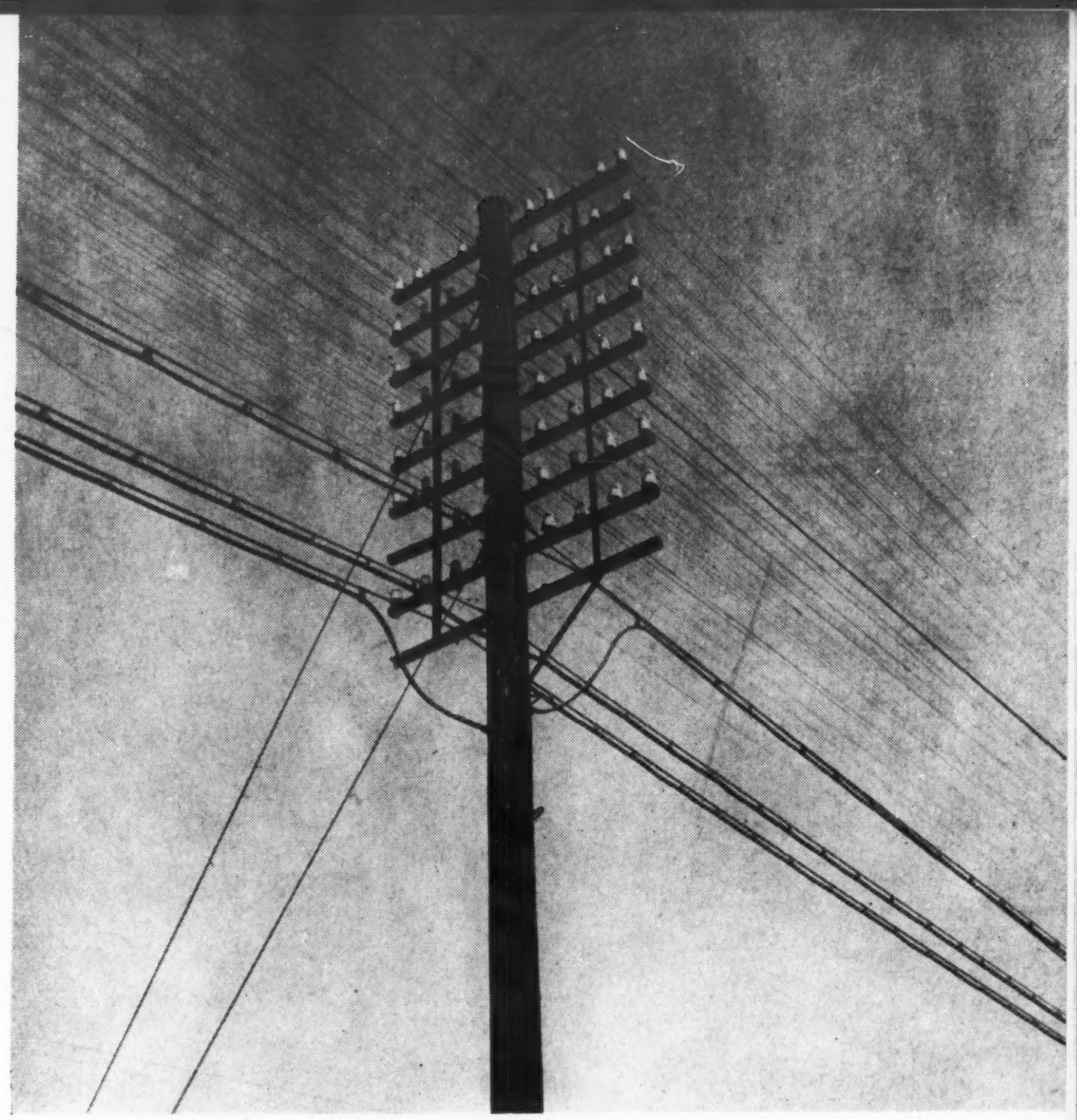
Long Wait for Telephone Calls

Apart from the usual "moshi-moshi's," "anone's," "ahsodesuka's," getting a call placed was no great problem, since apparently all Japanese operators recognize enough English to know place, names and numbers. However, the wait to get a party at the other end might take anywhere from fifteen minutes to three hours and, as a matter of actual fact, a friend of mine located near the Emperor's Summer Palace at Hayama was able to place a call to the United States in less time than it took him to get a party in Tokyo. (It should be pointed out that on leaving the country a large part of the sixty-six dollars was refunded, upon returning the telephone in good condition.)

The Japanese Signal Military Units are developing very rapidly along the lines of our own and the courses at the Japanese Signal School in Kurihama are copied after ours at Fort Monmouth. The school equipment they use is copied from ours, too, and represents a bang-up job, their version of our BC-610 being a case in point. It has several features that seem to me to be improvements on our similar equipment.

In the field of radar, for example, several large Japanese firms are building equipment for merchant ships and, as I watched the units coming from the production lines, I was struck by their skillful handwork and meticulous attention to details. Much work is done by hand which, in our country is performed automatically, but due to the large labor supply and low wage scale this apparently presents no handicap.

A visit to the central Japanese radio parts stores in the vicinity of the Ikebahara Elevated Railroad Station in the Kanda District of Tokyo is a happy experience for anyone interested in this field. The prices are a welcome relief, even to one accus-



by Colonel Fred J. Elser, SigC
Chief, Doctrine Office
The Signal School
Fort Monmouth, New Jersey

tomed to those in the surplus stores of lower Manhattan.

The Japanese Amateur Radio League is flourishing, and many Japanese amateurs are actively operating. They attend meetings with the Far Eastern Amateur Radio League of Americans and show a great interest in single sideband telephony and all the latest developments in the short wave field. In contrast to the prevailing United States amateur trend, nearly all of the Japanese amateur stations are almost completely assembled by their owners. The type of signals emitted and the operating proficiency of the Japanese amateur seems to me to be higher than before the Korean War.

Technicians Gain Experience

The Imperial University in Tokyo, home of Professor Nagaoka who developed the resonance formulas of early days, still has its Professor Yagi, a renowned scientist responsible for the close-spaced parasitic directional beam antenna.

Many Japanese technicians are utilized for the repair and maintenance of signal equipment, with mutual benefits to us and to them. What they gain in training and experience we gain in prompt savings of expensive equipment which otherwise probably would deteriorate.

Amateur operation for Americans does not exist as such in Japan, but a system of Auxiliary Military Radio Stations (AMRS) for short waves is authorized to operate on the numerous amateur frequency bands, provided no third party traffic is handled in accordance with the Japanese Treaty Agreement. Mobile operation is also forbidden. The MARS system is well established and handles many thousands of messages for servicemen each month.

The Marine Corps has set up a very effective single sideband system between their bases throughout the Pacific. With a combination of communications equipment available, augmented by the purchase of special equipment through non-appropriated funds, and directional Rhombic antennas, with regular operators assigned, the system is proving most effective in passing informal traffic expeditiously. Of course, all U.S. equipment has to be installed on United States Government leased property, so that individuals living in private rentals off-Post do not have the privilege of setting up transmitters at home.

Since Japanese homes are spaced just a little closer together than American homes, I was able to find out that my neighbor at Akaya, who had a loud speaker operating for eighteen hours a day, was a radio repairman, and this gave me a first hand opportunity to compare the modus operandi of a Japanese radio shop with one in the States. Their methods and equipment seem to be parallel to ours as they existed in this country on a pre-war basis, but while it seemed perfectly natural to see a bicyclist going down a narrow street balancing several bowls of noodle soup in one hand as he weaved through the crowd, somehow the same procedure with a large radio chassis substituted for the soup bowls did not seem quite normal!

It was with regret that we said "Sayonara" to Fujiyama. In Far East Signals many things are accomplished effectively, but they are not always done in the same manner in which we do them here.

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Typical of the types of projects Hoffman Field Engineers are working on, one group is presently engaged in conducting field evaluation studies at remote air bases on TACAN, the most advanced airborne navigation equipment yet produced. This field study is being coordinated with Hoffman's production of TACAN equipment.

NUMBER 4 OF A SERIES

Radar, Navigational Gear
Missile Guidance & Control Systems
Noise Reduction
Countermeasures (ECM)
Communications
Transistor Applications

CHALLENGING OPPORTUNITIES FOR OUTSTANDING ENGINEERS TO WORK IN AN ATMOSPHERE OF CREATIVE ENGINEERING. WRITE THE DIRECTOR OF ENGINEERING, HOFFMAN LABORATORIES, INC., 3761 SOUTH HILL STREET, LOS ANGELES 7, CALIFORNIA.

In one hundred words or less . . .

SPEECH RECESSION

by Christopher James

THE MOST SERIOUS PROBLEM facing the military, or for that matter, any type of communication engineer, is that people wish to talk. In these times particularly, this human trait causes our unhappy engineer to have nightmares on such mundane subjects as limited channels, bandwidth, and spectrum conservation.

Let me elaborate upon the general problem of garrulousness. It is axiomatic that people hardly ever get into trouble by what they do, but rather by what they say or imply. Now were I to ask a young, and shall we say, not-too-aspiring military communicator how to keep out of trouble and move toward a non-controversial retirement, I might say:

> "In promulgating your esoteric cogitations or articulating upon your superficial sentimentalities, philosophical and psychological observations on a military situation, remember always to employ platitudinous ponderosities, since then your communications will never encompass a trouble-making conciseness or compactive comprehensiveness."

Since this is a course of least commitment, there would be no serious problems for the lad following this unquestionably erudite suggestion—he would just be reassigned and often—and perhaps even promoted enroute. The real trouble would be for the men who engineer the multitudinous channels for such vocalists and who now look to the heavens for assistance on their traffic problems.

Loquaciousness is only a small part of the problem; however, the fact is our whole language is too cumbersome. *While the modern scientist deals in fractions of microseconds, we still talk with a pre-Columbus vocabulary made for Eighteenth Century poetry, Twentieth Century novels and ten-pound Sunday newspapers.*

* * * * *

Some years ago in this same learned journal (SIGNAL, May-June, 1952), I reported an ingenious plan for revolutionizing military communications. I called it the RANKOPHONE, and a neater proposal it has never been my pleasure to see. The trouble is, nobody read it—it was too long, even though I condensed it to less than 2,000 words. (The reader will recall that even 2,000 words is much shorter than Einstein's proposal on a Unified Field Theory, let alone mention his Special or General Theory of Relativity). The one comment I did receive from a friend of yesteryear, now in a mental institution, was . . . "Dear Chris, Wish you were here. Fascinating story you wrote, but about 2,000 words too long."

That expression of deep interest encouraged and inspired me over the intervening years to try and reach a larger and perhaps more representative group of SIGNAL readers, with something even more revolutionary in concept—I call it SPEECH RECESSION!

At this point we must first proceed backwards before we can go forward. I don't want to go as far back as Shakespeare and his 25,000 word vocabulary, but I do want to reminisce about the secret of those great fighting men from the old Cavalry and the warriors who drove the mules in World War I. In heroic retrospect, we see these men able to fight and win their wars with ten-word vocabularies. Those of you favored in being able to remember, or having once been a part of a mule team pulling a caisson through French mud, will, I am sure, never forget the effectiveness of this abbreviated vocabulary.

It is not entirely a military phenomenon. It extends even into civilian life!

I recall strolling on the beach one day with my wife, and my eyes departed momentarily from the restful view of the blue Atlantic to an abstraction in the form of a natural contender for the Miss America skill contest. For some strange reason the

rotary joints of my neck suddenly refused to function, and my eyes were frozen in azimuth, albeit some changes in elevation seemed possible.

"CHRISTOPHER!" my wife snapped, and suddenly by some strange force the motion of my neck returned as though my joints were lubricated by miracle.

Here is my point. In that one word "CHRISTOPHER!", she told me more than Shakespeare could have with his entire 25,000 word vocabulary—and the communications were perfect.

But back to the more formal military problem. If, (pardon the parallel) a driver of mules or my wife can put so much into one word, why not simplify our entire military vocabulary and so eliminate or greatly minimize the problems of bandwidth, limited channels, copper-plated battlefields, and the high ether-temperature caused by millions of radio, radars and others of the classified family ever adding to our military static?

Radical? Yes, but in many other instances the military does not hesitate and sets up special lines like electron tubes, tanks, submarines, WACS, atomic bombs, reconstruction projects . . . the list is endless. Therefore, I repeat, why not words too?

I boldly suggest an approach as follows:

(1) Ask the Army for the twenty-five most important words in their terrestrial vocabulary . . . (requires some research).

(2) Ask the Navy for the twenty-five most important words in their salt-water vocabulary . . . (common knowledge).

(3) Ask the Air Force for the twenty-five most important words in their celestial vocabulary . . . (requires some looking into).

(4) Ask any Marine for the three words he would least like to give up, excluding "leave" . . .

Add them and we now have seventy-eight words, representing the truly important thoughts, the transmission of which is the only function of the present military verbiage, adding, of course, the digits. The dollar sign ($), we can neglect, since money only causes trouble.

In heroic retrospect, we see these men able to fight and win wars with ten-word vocabularies.

To simplify our initial approach to the problem, I'd suggest we consider only the relatively close combat situation (land, sea or air) where the luxuries of teletype, facsimile and television have not yet permeated.

Since everyone already knows our requirements, we need only to pose the problem with certain limiting parameters and find a daring contractor who on a cost-plus-fixed basis will provide three quarterly reports and a final report, ostensively giving us the answer to our worries.

We would naturally seek for an organization skilled in linguistics, especially phonetics, morphology, semantics, general or philosophical grammar. Perhaps the Ivy League, the Big Ten or the Brooklyn Dodgers would take the problem. It could even be more absorbing than football or baseball. We would say to the august personages, having submitted the lowest bid, here are some "hot" words representing the major requirements of military thought which must be easily and quickly transmitted in battle. Build up a new military vocabulary based on these requirements, not to exceed one hundred words total.

We will make no mention of the added meaning which may be given to words by way of syllabic emphasis. For the purpose of keeping the contractor's morale high, it would seem best to allow him to discover this himself. Our contractor will discover too, but later. that once we es-

Surely, the teaching of 100 words should not be much of a task for skilled educators.

tablish this new vocabulary, it will be a simple step to move from the spoken word to the printed message. In other words, we can anticipate speaking directly into a microphone while the distant teleprinter types out military thoughts with one original and six carbon copies—a concept, ridiculous with oriental languages, impossible with English, but easy with RECESSED SPEECH.

In due course of time we will be given our 100-word "Military Esperanto," and the exciting time for field tests will have arrived. Our contractor will, undoubtedly, in the final report, give us our choice of trying the experiment and/or continuing the contract along another avenue which he suggests as worthy of investigation, but unfortunately at a larger fiscal outlay.

We decide on both based on precedent.

Each day becomes more exciting!

My plan is that a gigantic field experiment be set up under NATO. First, we gather troops from non-English speaking countries, including also sprinklings of men from Brooklyn and Texas. By and large, a Corps made up of such heterogeny could not possibly communicate within itself without interpreters.

In this experiment, instructors must first teach the entire Corps the new military lingo complete with syllabic implications, Leo Durocher being of great help to the faculty on the latter. Surely, the teaching of 100 words should not be much of a task for skilled educators. My boy in kindergarten is taught that many new words every month, with some truly good ones thrown in extra by his older schoolmates as he goes to and from school.

After one month's training, we should have a Corps able to move into combat with the latest weapons together with complete, or better yet, adequate communications. Overcrowded spectra, too much wire—none of these problems.

As for jamming, it would be too hard for an enemy to find our very limited communication net, it is not spread out, it is tucked in; we fight with SPEECH RECESSION!

Of course, what will actually happen in these experiments for which I suggest the name "Operation Babel" is not for me to say, although I have my own ideas. I now leave it up to the experts!

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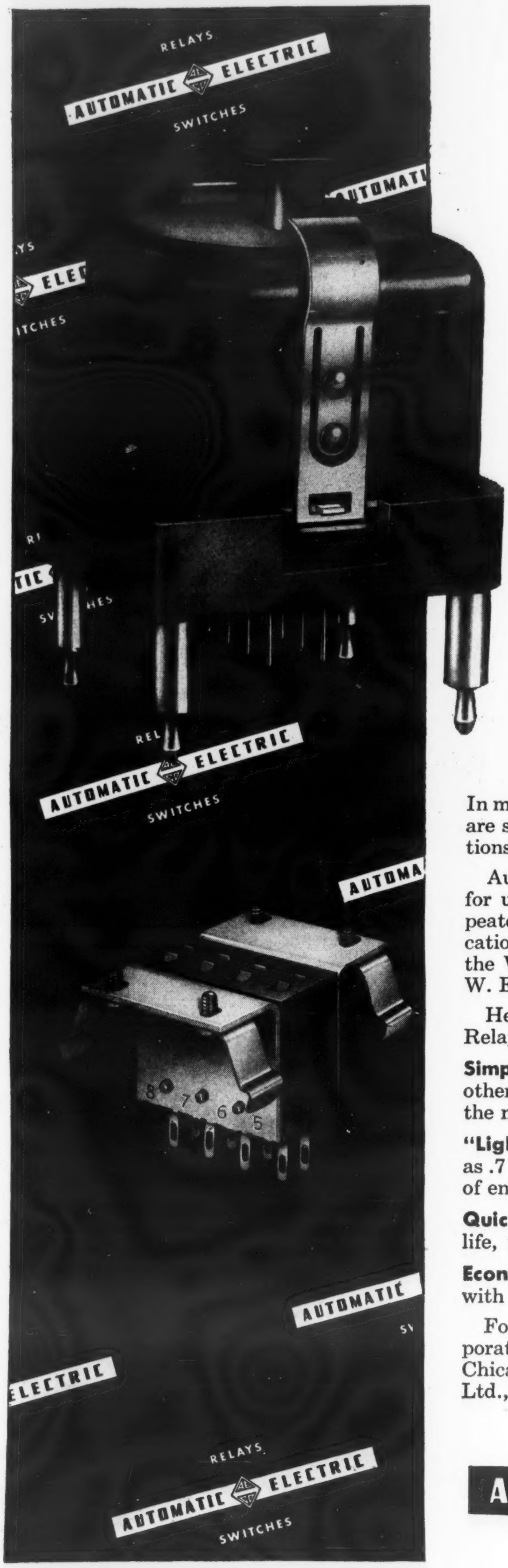

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RELAYS SWITCHES

PRODUCTS OF THE INDUSTRIAL DEPARTMENT OF

AUTOMATIC ELECTRIC

CHICAGO

An important survey of current Defense Department programs

Tube Reliability

by R. W. Shepard
Signal Corps Engineering Laboratories

Experience gained in World War II and in the Korean conflict clearly demonstrated that the efficiency of electronic equipment depends directly on the life and ruggedness of the electron tubes used in the equipment. As a result of this experience, the Department of Defense decided to conduct studies on tube failures and to endeavor to develop a program which would assure greater reliability in electron tubes used in tactical equipment, at the same time benefitting industry. With this program as a goal, the Department of the Army, coordinating with other Services, initiated a program in 1950 at the Signal Corps Engineering Laboratories, Fort Monmouth.

Naturally, the initial approach to the problem was a determination of the cause of failures and the environmental conditions under which these failures took place. A field surveillance program and a laboratory analysis program were the first steps to be considered and initiated.

Because of the enormity of the task, it was decided to use the facilities of industry and Government laboratories in a coordinated effort which is effected through the office of the Advisory Group on Electron Tubes (a joint Service project) under the Assistant Secretary of Defense for Research and Development.

A joint Service contract, administered by the Department of the Navy, was awarded to Aeronautical Radio, Inc., Washington, D. C., to study environmental conditions surrounding the failures. ARINC, in turn, sends the tubes to Cornell University which has a contract, under the sponsorship of the Signal Corps, for analyzing the cause for failures in the tube.

In order to obtain a cross section of the causes of failure under varying environmental conditions, tubes are collected from many parts of the world from a variety of equipment types. For example, tubes from fire control and radar equipments are received from Fort Bliss, Texas, tubes from fixed plant communications equipments are under surveillance at Station WAR, Washington, D. C.; tactical equipments in the European Commands (EUCOM) are monitored for tube failures. In cooperation with the Ordnance Corps, guided missile equipments at Fort Bliss, Texas and White Sands, New Mexico, have been brought under the surveillance program within recent months.

Rejects Tested and Analyzed by the Thousands

The scope of this investigation is better appreciated when it is realized that over 12,000 representing 385 different types have been received for analysis. Approximately 1,500 tubes are processed each week by Cornell University and the results coordinated and integrated by ARINC with environmental data previously accumulated.

Cornell University is also concerned with surveillance of equipment production-line tube rejects. It has often been determined that a tube meeting a Military Specification (abbreviated MIL, a joint three department coordinated specification), when tested in a production equipment, does not measure up to the requirements of the equipment. When the reject rate of such tubes becomes greater than 1% to 2%, a manufacturer may make arrangements with Signal Corps (through his Government contracting officer) for rejected tubes to be sent to Cornell University for analysis without cost to the manufacturer. This service has been mutually profitable to the manufacturer and to the Government. It enables a careful comparison to be made of samples of tubes, usually manufactured during the period of use, obtained from a particular source and used in a particular socket. This type of operation was successfully pioneered at the Allen B. DuMont plant at East Paterson, New Jersey, in connection with the production of Signal Corps equipment.

The SCEL Electron Tube Reliability Program covers many useful and interesting fields of endeavor. One important phase is an aid and guidance service to tube users, since it is believed that misapplication of an electron tube may often be a serious deterrent to the achievement of reliable tactical equipments. As has been mentioned, the success of an equipment often depends on the type of electron tube used in the equipment. Based on experience gained through many years of research and development of electron tubes, tube engineers at SCEL have attempted to educate equipment designers on the capabilities or limitations of electron tubes operating under various electrical conditions over a wide range of environments and provide the designers with data for safe and efficient operation.

It is interesting to note the splendid spirit of cooperation existing between industry and Government in this all-important subject of electron tube reliability. A joint Service contract, administered by the Signal Corps, provides for support of the Advisory Group on Electron Tubes. Through this coordinated effort, the services of approximately 130 application engineers from the tube industry have been made available by industry to constitute application task forces. Working in task teams of three or four, these men visit equipment manufacturers and Government installations upon request of a particular Service and assist in reviewing and analyzing application tube problems arising in development or production. The teams are supported cooperatively by industry and Government.

Handbook Being Prepared

A significant advance is being made in the tube reliability program in the accumulation of data to be used in the preparation of an Equip-

ment Designers Tube Handbook. A Signal Corps-sponsored contract with the General Electric Company at Owensboro, Kentucky, call for studies to determine safe ratings for reliable tubes under various conditions of use. It is proposed to have the book contain information on the life expectancy of tubes operating under various conditions and environments, such as heater voltage, heater cycling, pulse operation, constant current, voltage and dissipation, high ambient temperature, vibration and shock.

Approximately 35,000 tubes of many types from several manufacturers are being tested for 5,000 hours. This effort represents the first large scale attempt to obtain such data under a variety of conditions and compile the data into a book for reference purposes. A similar contract, sponsored by the Signal Corps, with the Burroughs Corporation is expected to produce data on tube life under computer type pulse operating conditions. Such data will also be included in the proposed book.

Still another important step in the tube reliability program is the "Summary of Electron Device Operating Conditions." This form, with variations, has become universal in many of the Services and has proven invaluable to the equipment designer and the Government in studying tube requirements of an equipment. Submission of the form is required under certain contracts and accompanies the first engineering model submitted for test. The summary achieves two important objectives:

(1) It requires the equipment engineer to carefully analyze tube data as he prepares the chart;

(2) It indicates tube conditions which may prove unfavorable or dangerous;

(3) It enables tube specialists to review and analyze circuitry of equipment under development or in preproduction stage in an attempt to prevent later tube troubles.

Lending Library Proposed

In the Signal Corps Engineering Laboratories, experimental models are subjected to vibration and shock tests as specified in equipment specifications, using accelerometers having the same mass as the tube in particular sockets. The accelerometer results are entered on the summary chart and submitted to the laboratory having cognizance of the equipment and contract. These early tests, conducted as they often are before design is frozen, tend to eliminate many of the difficulties heretofore experienced in the use of equipment and tubes in the field.

A very important service is in embryonic form, namely, a Lending Library of Limit (Range) Tubes for Equipment Designers and Manufacturers. "Limit" tubes are tubes having known characteristics either at the minimum or maximum specification value for a given parameter. It is believed that a large number of application errors may be avoided if tubes could be loaned for experimental purposes, thus preventing the design of equipment having hypercritical circuits (circuits requiring careful tube selection for proper functioning).

The Signal Corps sponsored a contract with Cornell University to determine the feasibility of the requirements for setting up such a library. Results of the investigation indicate that the idea is feasible and that a satisfactory method of operation is possible. A new contract to establish such a library and service is planned. Under the library arrangement, limit (range) tubes would be loaned to equipment designers and manufacturers for test purposes on a no-charge basis to determine how critical-developed circuits affect the variation in tube characteristics. Development of such a library will certainly be to the advantage of manufacturers and Government alike.

Automatic Tube Manufacture

It has long been recognized that the human element plays a large part in electron tube manufacture and could possibly be responsible for many of the difficulties experienced in electron tubes. Recognition of possible failures due to the human elements led to the concept of Automatic Tube Manufacture. One reliability approach is based on the premise of automatically building reliability into tubes rather than relying on test requirements to cull out unreliable tubes. With this object in mind, a Signal Corps-sponsored contract was awarded to develop an automatic method of tube assembly and processing.

The work is based on a stacked element tube devised by the Signal Corps. The development of the tube and machinery for automatic manufacture of the tube is progressing satisfactorily. A high degree of flexibility has been introduced into the basic tube and machine design so that it is believed possible to produce twelve different types of tubes merely by changing some of the machine fixtures. Automatic tube manufacture will not only revolutionize tube making but will also make it possible to obtain highly reliable tubes for delicate guided missile work. The labor element in this latter field has been the subject of great concern to the Signal Corps Industrial Division. *Automatic tube manufacture is expected to be one of the greatest strides made in several years in the tube industry.*

In 1951, the need for facilities for environmental testing became apparent. As a result, a modern mechanical test laboratory for electron tubes was set up in the Signal Corps Engineering Laboratories. The facilities consist of shock and vibration equipments (salt spray, fog, humidity, altitude and freeze box chambers) and centrifuge equipment.

"All Environmental Tube"

Field failures and reports of tube failures by guided missile manufacturers led to a literary study of military environmental conditions with the intent to prepare a basic "mechanical specification" for all electron tubes. As of December, 1952 comparatively little data were available, and detailed information regarding the frequency limitations of those recorded was never included in available data. Since it was evident that neither the desired data nor equipment to gather such data was available, a development contract was awarded for accelerometer and recording equipment. This equipment is expected to be delivered in the near future to the Signal Engineering Laboratories. As previously mentioned, data accumulated from accelerometer tests will be listed in the Signal Corps Engineering Laboratories on the form "Summary of Electron Device Operating Conditions."

To obtain an "all environmental electron tube," a development is underway for a tube to meet all present mechanical specifications on electron tubes plus the mechanical requirements specified by guided missile manufacturers. Environmental data obtained from the Navy Bureau of Ordnance and from Air Force representatives on guided missiles indicate that the proposed Signal Corps development and its objective specifications are a big step in the right direction for greater tube reliability.

It is obvious that in order to obtain greater tube reliability, it is necessary to consider improvements in existing tube types. Among these types there may be mentioned:

(*Continued on page* 90)

more on mobilization

PLANNING

A Key to Survival

by Paul A. Longo
Chief, Planning Division
New York Chemical Procurement District
U. S. Army Chemical Corps

IT ALL STARTS WITH THE STRATEGIC PLANS OF THE Joint Chiefs of Staff. The Plan contains the strategic scope and course of military action which must be taken for survival and serves as a basis for the computation of mobilization requirements by the Army, Navy and Air Force.

"What", "When", and "How Many" military supplies are needed to conduct this action? The "What" is tanks, planes, ships, bombs, rockets, radar, guns and ammunition; 'When" is the time that these items will be needed for a national emergency; and "How Many" is the total number of items required.

While this "What," "When," and "How Many" equation is geared to combat operational missions by the military strategists, the equation can become a reality only after the implements of war have been produced. The logistics appraisal is meaningless without the industrial partner, for the *Industrial Partner,* ready to produce war weapons, *is essential for survival.*

Department of Defense Programming

Industrial production needs require that industrial management be made a member of the mobilization planning team. The "What," "When," and "How Many" plan is the Department of Defense activity which works with the industrial partner to organize production potential into an important segment of the Mobilization Production Base.

The Department of Defense Production Allocation Program is one phase of this plan. This Production Allocation Program activity, modified and streamlined over the past several years, locates and evaluates industrial support necessary for military activities called for by the strategic military plans of the Joint Chiefs of Staff. This industrial support is the Industrial Production Base.

Since 1948, both military and industrial planning experts have conducted extensive studies on methods of converting industrial might into military power. These studies are the basis for the Production Allocation Program, the present formula for conducting mobilization planning with American industry.

Schedules of war production are arranged by the Army, Navy and Air Force with individual plants and corporations for manufacturing specialized military items in event of mobilization. By accepting M-Day production schedules, these facilities, regardless of size, will be the industrial partners in planning production and allocation of their output to the military user. Because the plan is voluntary, control of the distribution of production capacity by industry is a part of this plan. This means that, during planning, industry may accept or reject any military schedule proposed, or in turn, may reject an Army schedule and accept one from the Navy or Air Force. Briefly, this plan permits industry to select its partners. It is purposely designed in this manner so that the proper production capacity may be allocated to the military item which it is best adapted to produce.

Realizing the necessity for the development of this kind of comprehensive industrial mobilization planning, industrial management has responded without reservation. Industrial management and the Department of Defense Field planner—known as the Armed Services Procurement Planning Officer (ASPPO), consider production schedules at rates balancing the needs of military plans. The voluntary agreements concluded indicate to the Joint Chiefs of Staff planners the capabilities of industry and individual suppliers to furnish needed critical items. Plant by plant and item by item, planning on a national scale will create the military production base needed for survival, retaliation, and sustained combat.

This total plan means that within a minimum of time

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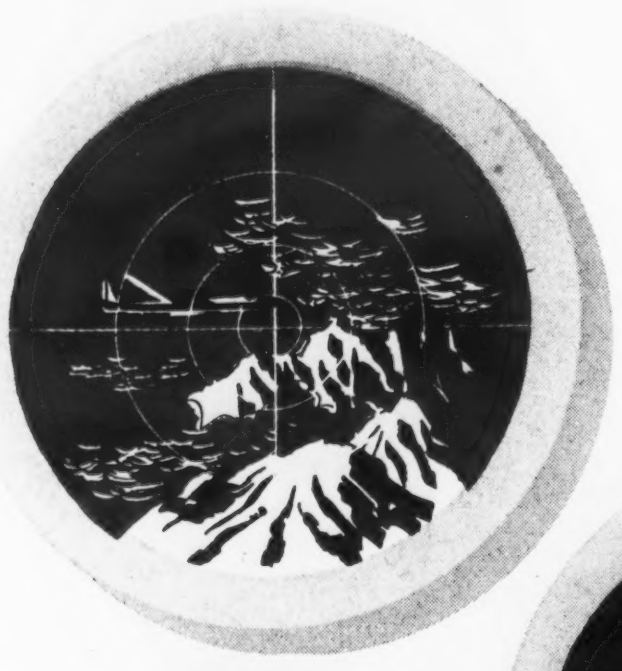

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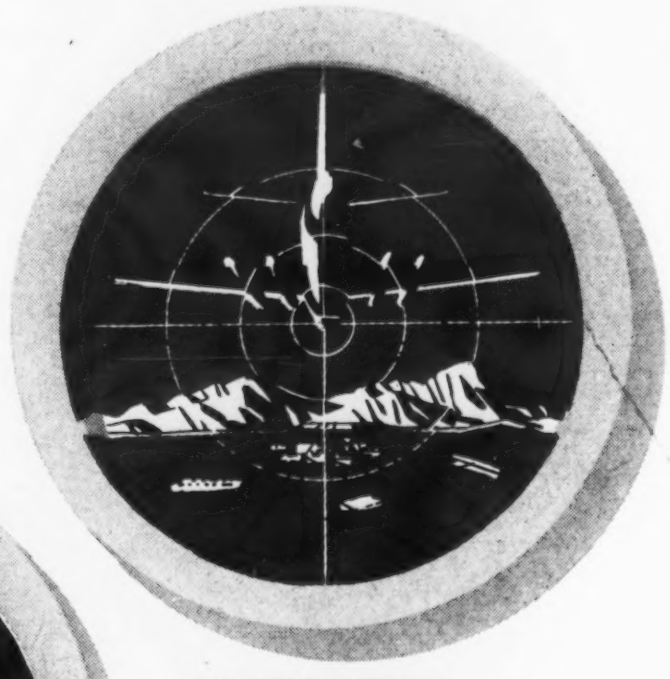

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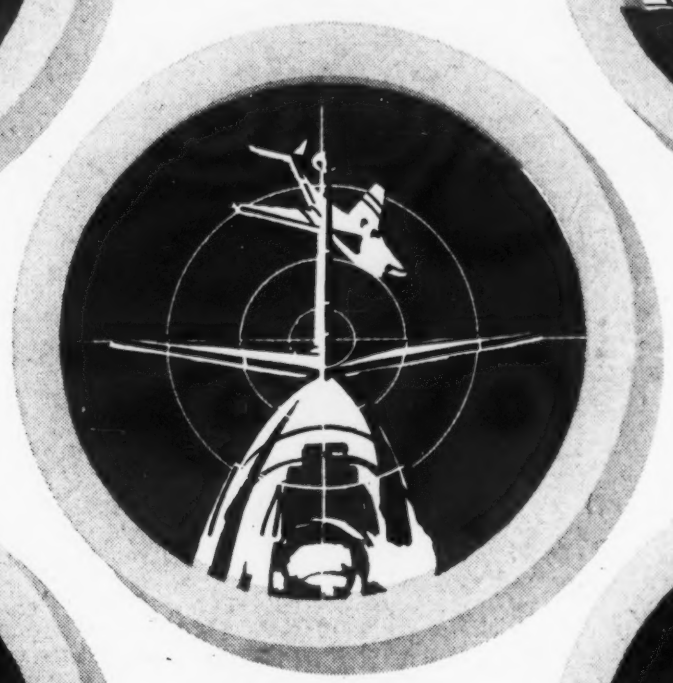

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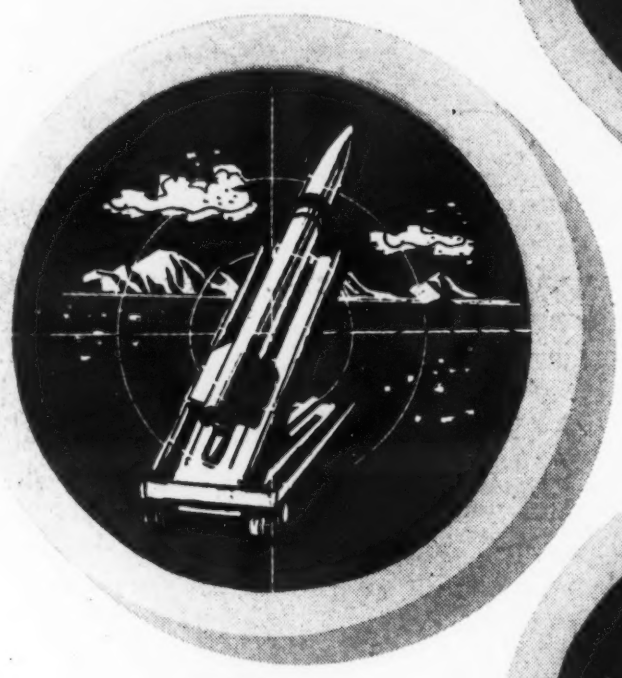

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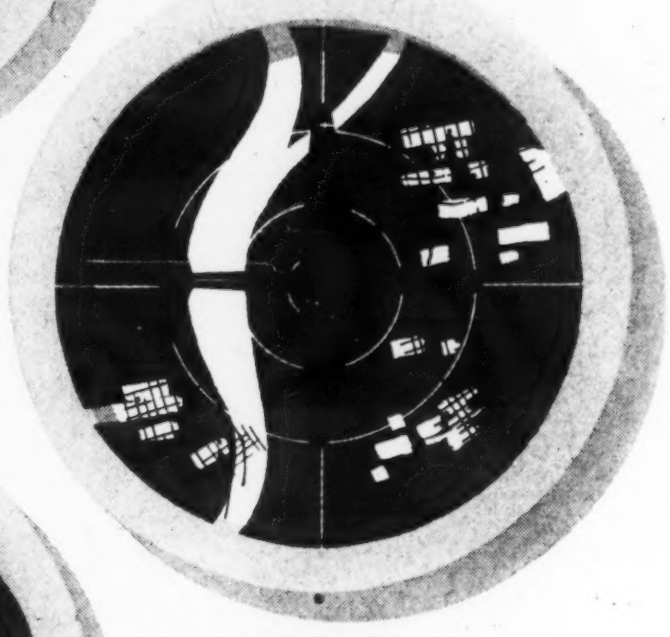
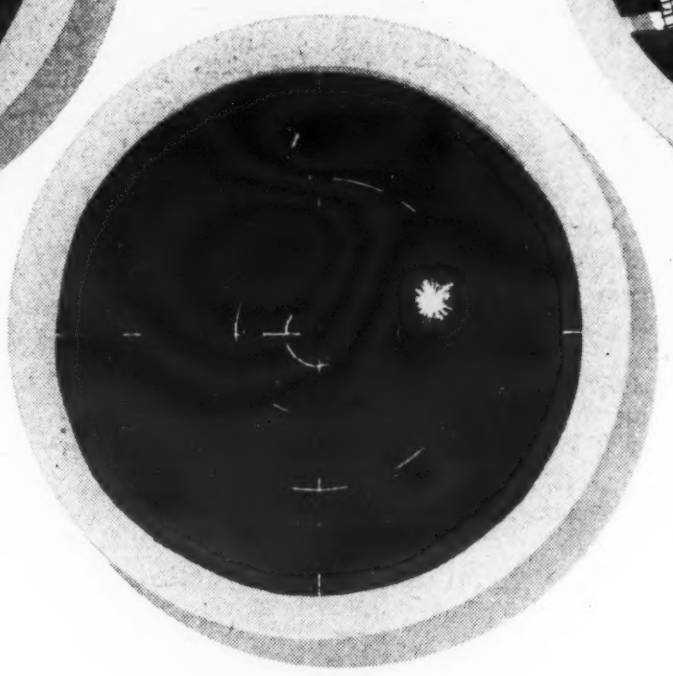


MAPPING RADAR



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a base of production can be activated to provide most of the critical survival and retaliation needs of the United States military machine. This is why the plan is referred to as one of the keys to survival.

Many critical end items require considerable procurement lead time. Production will not be available to satisfy the needs of the period immediately following Mobilization Day. There may be a difference between supply and demand during the early period after M-Day. Certain quantities of stock must therefore be on hand as current stockpile to form a mobilization reserve.

Stockpiling Necessary for Some Items

The Mobilization Reserve Materiel Requirements is a segment of the Army Materiel Program and is provided for under the peacetime budget procedures to assure that a balance is maintained within the Mobilization Reserve Stock Program. This reserve is determined by comparing mobilization requirements with scheduled mobilization production capacity. The capacity is reported by the Armed Services Procurement Planning Officer in the Tentative Schedules of Production, DD Forms 406, arranged with industry.

The acceptance of these schedules of war production by industry is by no means simply a "paper planning" exercise. On the contrary, each schedule plays an extremely important part in the nation-wide military plans. The "calculation" of the ability of the nation to defend itself and carry on a war, if required, is largely dependent upon these production schedules.

The strategic plans of the Joint Chiefs of Staff are directly dependent upon the support rendered by industry in the present mobilization planning efforts. The military planning representatives are acutely aware of the role of industry. Therefore, they critically analyze and evaluate industry's capabilities. Emphasis is placed on the manufacture of selected critical military end items for which industrial production capacity is allocated to the Services.

A capability study may show a lack of sufficient industrial production capacity. Stockpiling of an item or a critical component is then necessary. Many factors are considered when stockpiles are required. Some of the more important factors are: deterioration rates, obsolescence, cost of the item, production lead time, and consumption rates. In the event standard items are replaced by newer designs, secondary use for training is considered and affected where possible.

Stand-by Facilities Reviewed

There are items for which stockpiling is not feasible and production facilities are inadequate to meet the wartime military demands. The production base for such items is established by contracting with industry for engineering studies known as Preparedness Measures. Such a study, as an example, may be for a plant design. If the situation is critical enough to justify further action and funds are available, plant construction is authorized.

The military production base consists of presently available industrial facilities to be converted on M-Day and government-owned, stand-by plants and equipment. These stand-by facilities, designed and equipped to produce the specialized items, are maintained for use on M-Day. Government plants sold to private industry after World War II were sold with the stipulation that the government could repossess them under the national security clause. The items presently produced at these plants are not necessarily the same items for which the facilities were originally designed. Reconversion, therefore, may be necessary.

The design of government-owned facilities maintained in a standby condition is periodically reviewed by the planning engineers. Modern manufacturing techniques may be introduced to effect greater economy in operation and increased output. Technological changes resulting from industrial research are considered for improving the plant processes where applicable.

The many factors considered in the execution of the program by field military planners have commanded the respect of industry. The combined management and "production line level" approach to the program is similar to planning for commercial production.

A completed production plan may constitute all or part of the following: facility analysis, cost factors, lead time consideration, manpower requirements, tooling, inspection, packaging, raw materials, transportation, and scheduling of controlled materials. Mobilization planning is conducted with subcontractors supplying critical components as well as end item producers and follows the same sequence of planning as is conducted with the prime-producing facilities. The means are provided for training through the implementation of educational production projects for those items not previously produced nor having a commercial counterpart. Through this device, tooling is acquired and production methods and inspection procedures are developed at the plant level and documented for future utility. This type of planning conducted on a managed cycle basis is targeted to develop the mobilization production base commensurate with mobilization requirements.

Dispersion Aids Security

Military experts have contended that the delivery of lightening blows at production resources can liquidate the capacity of a nation to conduct war. The technological advances in the field of aeronautics, guided missiles, and thermonuclear weapons have increasingly demonstrated the need for dispersion of the production base. Therefore, the production facilities established in support of the mobilization requirements are scattered throughout the country. There is much to be done in this connection, through gradual revisions of the existing plans and the relocation of production lines. This does not mean that the plans are duplicated for each facility. Segments of production requirements are assigned to different areas.

As an example, a schedule for flamethrowers may require the major output of several industrial facilities. These facilities are selected at locations strategically dispersed. Schedules are arranged so that in event of total destruction of a plant, the remaining facilities could make up the production deficit. This phase of planning is of primary concern when selecting sources of supply. Similarly, technical data and other production plans are maintained in strategically dispersed areas by the military agencies.

Continuing and close coordination of these planning activities is essential. This is necessary in order to maintain the established M-Day production base current. Industry and the Government, in a common effort, are providing the means whereby the military needs of the United States will be met in the event of total war. Without this industrial contribution to the planning effort mobilization plans would be limited and incomplete. Because of this continuing cooperation, defense readiness is becoming a practical reality. Although the tax dollars appropriated for this purpose are relatively few, the returns are huge dividends in preparedness.

Quotes in Review

a survey of major statements made during the past two months

"The greatest cause of the present unacceptable level of reliability in military electronic equipment is the lack of maturity of product design and failure to evaluate the inherent reliability of design, through realistic engineering tests and service and materiel evaluation, before major production is undertaken.

"Primarily, this is the result of two somewhat conflicting points of view. Operational and logistics planning officers understandably urge early production of advanced new weapons and associated devices to meet planned military requirements. On the other hand, research and development people generally tend to emphasize the attainment of basic technological goals, often neglecting the laborious and less glamorous job of thoroughly engineering their creations for production and service use.

"Far too often, both the operational man and the research and development man interpret a successful functional demonstration of the first experimental model of an equipment or weapon system as indicating its readiness for production. Unfortunately, the greater the technical achievements in the basic development of an item—with correspondingly increased potential tactical capabilities (and usually equipment complexity)—the greater the urge to hasten production for service use.

* * * * *

"Many of us have fallen into a complacent but erroneous state of mind wherein we feel that if an equipment incorporates all JAN components and reliable tubes it will be satisfactory in service. We overlook the fact that these components and tubes will actually be little, if any, more reliable than those manufactured for home television and radio if we overload them or use them in over-critical circuits or place them in mechanical designs that overheat them or subject them to severe mechanical amplifications in vibration or shock."

J. M. Bridges
Director of Electronics, Office of the Assistant Secretary of Defense (Applications Engineering)
Working Conference on Reliability and Maintenance of Electronic Equipment, RETMA

"Automation in one form or another has been with us since the beginnings of the Industrial Revolution. Its greatest recent development, however, has been intimately associated with the growth of the electronics and communications science and industry. Needless to say, the Army Signal Corps, whose primary business is with communications and electronics, has a vital interest in furthering the application of automation in the Army.

"I can classify the Army's interest in automation into three major categories. Together they have one common objective: to increase the combat effectiveness of the Army.

"In the first category are our weapons systems and strategic and tactical operations. Efforts to apply automation in such areas as air defense, fire control and guided missiles have already proved successful. In military communications, we have been extensively applying automatic teletypewriter switching centers ever since our initial installation in Chicago in 1952.

"In the weapons area, we are just on the threshold of automation's potential. Under the demands of new concepts of ground warfare which the Army is now developing and testing, automation is going to play a major role in tactical communications, battlefield surveillance, air navigation and traffic control, and electronic warfare. At our Army Electronic Proving Ground at Fort Huachuca in Arizona, new doctrines, devices and systems are daily being tested and refined.

"The second major category is the business and administrative affairs of the Army. Here is included logistics, financial management, personnel and manpower administration, record-keeping, etc. We are trying to apply electronic data processing systems to the handling of our vast amounts of data and clerical transactions. Already, major high-capacity data processing systems are being acquired and will be installed during this fiscal year at the Ordnance Tank and Automotive Center in Detroit and at the Signal Corps Supply Agency in Philadelphia. The Army Map Service has been using a high-capacity electronic data processing system for the past four years.

"Major studies are now going on for exploitation of automation systems in other areas of supply management. Involved in these studies are our depots, stock control points, procurement agencies, industrial mobilization offices, posts, camps and stations, and units in the field. The Army is also conducting studies and tests for new concepts in supply and manpower activities. Here again, our approach is based upon maximum exploitation of

electronic data processing systems. Of particular interest, we are engaging in major field experiments to prove the feasibility of these new concepts. Just as we test tactical concepts at Fort Huachuca, so do we engage in developing and testing ideas for modernizing and improving the Army's business management.

"The third category is the exploitation of automation in the production of components and end items of military equipment. Here, of course, our efforts are aimed in two related directions: to obtain better equipment at lower cost and to reduce the costs and problems associated with repair and servicing, and to augment our industrial mobilization base through automatic production techniques. I do not need to elaborate on the Army's efforts in this field. . . .

"These are only a few of the things which have been done in relating automation to our combat mission. While much greater progress lies ahead of us, we are at the same time aware of serious problems which need attention. . . .

"First of all, we need a greater pooling of knowledge on the subject of automation. With new machines and techniques being developed on broad fronts, some means must be found of keeping us aware of what is going on. This is particularly true with respect to obtaining data on experiences and techniques derived from actual employment of automation systems and devices. . . .

"Along with this need for awareness is a strong requirement for an intensive research and development effort. In automation, we are dealing with a dynamic art, one which is changing rapidly. New requirements as well as major technical advances, offer the prospect of great improvements. To use it to best advantage, we must know where we are going with it, but, most important, how we can avoid saddling ourselves with systems and methods which may quickly become obsolete."

Major General James D. O'Connell, USA
Chief Signal Officer
RETMA Symposium on Automation

"We should remember that nearly the only way in which [radioactive] fallout would be observed is by instruments, the precipitate being so fine as to be difficult to see. A contaminated area may look little different from an uncontaminated area and there would be no certain way except by the use of instruments in which to determine the degree of contamination. It is clear, therefore, that the Federal Civil Defense Administration, the states, the counties, and the cities all have a two-fold task in dealing with radioactive fallout—to furnish the instruments and to educate the people in their use and in the understanding of the principles of radioactivity, a knowledge which could prove to be vital. The Atomic Energy Commission is anxious to assist in any way it can in these tasks. We hope that the public discussion of radioactive fallout which has occurred already has helped serve the educational purpose to a considerable degree.

* * * * *

"Direct experiment *is* possible by using the minute fallout which occurs outside the testing areas over essentially the whole hemisphere whenever bombs are tested. Apparatus is available which will measure this tiny amount of material, thousands of miles from the test sites, and I believe you will agree that the assumption is likely to be sound that the susceptibility of test fallout to decontamination measures will closely resemble that of actual heavy fallout in case of attack. It is probable that the dust particles will be only slightly finer in the case of the test fallout. A great deal could be learned by taking typical buildings, streets, and countryside, monitoring them for general fallout, and then subjecting them to various decontamination measures and re-monitoring.

* * * * *

"A policy of experimental attack on the persistence of fallout questions and the testing of various reasonable decontamination and protective measures will give everyone a better understanding of the problem, better judgment about the various unavoidable policy decisions, and help to interest people in helping protect themselves against these possible dangers."

Dr. William F. Libby
U. S. Atomic Energy Commission
Fourth Annual Conference of the
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Introducing AFCEA's New Group Members

Alden Electronic & Impulse Recording Equipment Company

A new group member since October, the Alden Electronic & Impulse Recording Equipment Company of Westboro, Massachusetts, was welcomed into the AFCEA in October.

Company representatives serving in the Association will be J. M. Alden, president; Milton Alden, treasurer; H. B. Hills, sales manager; E. D. Cross, engineering director; S. C. Sviokla, engineer; W. P. Eggert, advertising manager; R. N. Vincent, service engineer; and Joseph Nestor, applications engineer.

Companies Accepted for AFCEA Group Membership Since September 1, 1955

*Alden Electronic & Impulse Recording Equipment Co.
Westboro, Massachusetts
†Barker and Williamson, Inc.
Upper Darby, Pennsylvania
*Mullard Ltd.
London, England
*Surprenant Manufacturing Co.
Clinton, Massachusetts
*Yale & Towne Manufacturing Co., Powdered Metal Products Division
Franklin Park, Illinois

*Brief notes about these companies appear on this page.
†Brief notes about this company will appear in the January-February issue.

544 new AFCEA individual members from September 1 to November 1

Let us be the first to wish you
A Merry Christmas!!!
the staff of AFCEA and SIGNAL

Mullard Ltd.

Mullard Ltd. of London, manufacturers of radio valves, cathode ray tubes, electronic components and equipment, joined the AFCEA in August.

Firm officials who will be representatives in the Association are: H. St. A. Malleson, L. Atherton, D. R. Bailey, D. H. Barlow, D. F. Egan, G. A. Gilbert, T. F. Hargreaves, G. Knott, Dr. J. D. Stephenson, B. L. P. Terry, and F M. Walker.

Surprenant Manufacturing Company

The Surprenant Manufacturing Company of Clinton, Massachusetts, manufacturer of wire and cable, became a group member of the AFCEA in September.

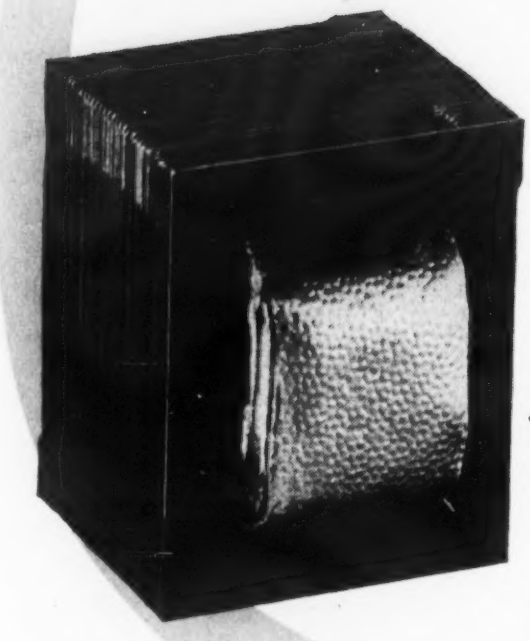
The following officials of the firm who will be included in this group membership are: A. H. Surprenant, president and treasurer; G. E. Forsber, vice president; E. M. Quill, assistant treasurer; D. C. Alexander, chief engineer; E. Bennett, chemist; R. Bullard, electrical engineer; Albert Copp, chemist; Dr. F. Butler, chemist; P. Haroian, chemist; C. Martin, mechanical engineer; and W. M. Land, Jr., chemical engineer.

Wac Engineering Company

Another recent addition to the AFCEA is the Wac Engineering Com-

(Continued on next page)

Preliminary plans for the 1956 AFCEA National Convention to be held May 24, 25 and 26, under the sponsorship of the Boston AFCEA Chapter, were mapped out at a late September meeting in Boston. Joining in the discussion were (left to right)—Gardiner G. Greene, Boston Chapter President, George W. Bailey, AFCEA National President, David R. Hull, Convention Committee Co-chairman, George P. Dixon, AFCEA Executive Vice President, Raymond Meader, Convention Committee Co-chairman, and William C. Copp, exhibits manager for the Convention.



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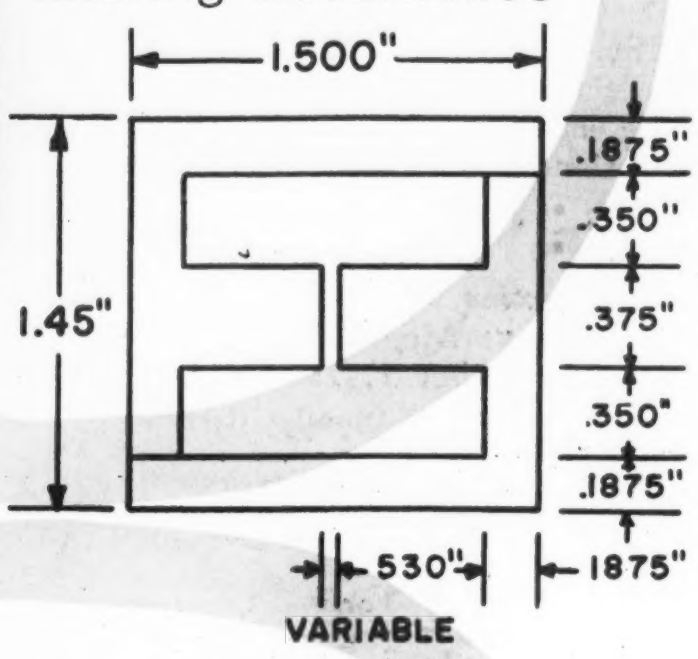

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Webster-Chicago Corporation, Government Division

The Government Division of the Webster-Chicago Corporation, Chicago, Illinois, is another company to become a group member of the Association.

Serving in the AFCEA as company representatives will be H. D. Von Jenef, vice president and general manager; C. H. Meuche, applications engineer; H. L. Schenck, chief contracts administrator; R. Orwin, chief estimating engineer; J. M. Miller, works manager; C. S. Wybran, director of purchases; J. Pettus, chief engineer; H. Tayloe, Washington counsel; R. Bilhorn, assistant chief contracts administrator; and D. O'Connor, director of quality control.

The Yale & Towne Manufacturing Company, Powdered Metal Products Division.

Another company to become a group member of the Association in September was the Yale & Towne Manufacturing Company, Powdered Metal Products Division, of Franklin Park, Illinois, manufacturers of powdered metal parts.

The officials included in this membership are: Mitchell Swentek, manager, Ferrite Sales; George L. Bachner, general manager; Henry S. Shroka, general sales manager; and Albert L. Fox, director of industrial engineering.

Mrs. John R. Redman Dies

Elizabeth Clemons Redman, wife of Rear Admiral John R. Redman, Commandant of the 12th Naval District, died recently in Oakland, California.

Mrs. Redman will be remembered by many members of the AFCEA because of the active part Admiral Redman has taken in the Association. During the period from 1949 to 1951 when he was Director of Naval Communications, Admiral Redman served as a Director and National Vice President of the AFCEA.

Winged Victory

The NIKE (ny-key) guided missile system — one of Uncle Sam's most fantastic new defense weapons against invader aircraft — is now being installed at strategic locations about the country.

Named after the Greek goddess of victory, it is capable of tracking down and destroying any existing type of plane, regardless of its speed, no matter how high it flies, what evasive action it takes. Nike's brain, which makes this possible, fills several large vans with complex electronic equipment — and employs much of the basic technology used to guide dial telephone calls.

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NIKE is one more instance of the important contribution telephone technology is making to the national defense.

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Chapter News

Arizona

The chapter's first regular meeting was scheduled for October 10th at the Fort Huachuca NCO Open Mess Annex.

Featured speaker was Ben Blom, Technical Director of the Engineering and Technical Department, Army Electronics Proving Ground, who presented a lecture-demonstration entitled "What is Hi-Fi?".

Highlight of the evening was the presentation of the chapter charter by Lt. Col. G. Daniels on behalf of Brig. Gen. Emil Lenzner, Commanding General, Army Electronic Proving Ground. In presenting the charter to President William E. Feist, Colonel Daniels outlined the background of the chapter's organization and reviewed the aims and objectives of the Association.

The results of the letter ballot for election of officers and directors for 1955-56 were announced as follows: president—Col. Kirk Buchak, Army Electronic Proving Ground, Fort Huachuca; vice-president—Arthur Mudgett, AEPG; secretary—Frank A. Carollo, AEPG; treasurer—C. P. McCourt, AEPG; directors—Dr. Robert E. Samuelson, Motorola, Inc., Phoenix; H. B. Klaiber, Plant Manager, Mountain States Telephone and Telegraph Co., and Dr. Robert O. Burns, Chief Scientist, AEPG.

The dinner-meeting was attended by forty members and guests. Among those present were representatives of the Chambers of Commerce of the surrounding communities.

Atlanta

National President George W. Bailey addressed the October 10th dinner-meeting which inaugurated the chapter's activities for 1955-56. Held at the Fort McPherson Officers' Club, the meeting was attended by some 150 members and guests.

Chapter of the Year—South Texas

In his report to the chapter, President Bailey emphasized the steady growth of the Association, both in size and influence, and stressed the vital role it plays in furthering the aims and objectives to which it is dedicated.

The meeting was presided over by Col. A. R. Morley, chapter president. Mr. Bailey was introduced by Jack Evans, first vice president.

Augusta-Camp Gordon

The chapter's August 18th dinner-meeting was addressed by Frank A. Woods, Information Manager, Georgia Division, Southern Bell Telephone and Telegraph Company.

During the business session, activity reports were presented by the chairmen of the standing committees. After a general discussion of the relative merits of various meeting places, it was decided that Timmerman's in Augusta would be the site of future meetings and that the third Thursday night of each month would be the date.

The role of aviation in the Signal Corps was highlighted at the September 15th meeting by Lt. Orlo C. Olson of the Aviation Branch, The Southeastern Signal School. Lieutenant Olson stressed the differences between the missions of the various aviation branches supporting Army units as an integral part of each unit and under the complete control of the commanding officer, as compared with the general concept of the use of aviation as employed in the United States Air Force. With the aid of slides, he described the various types of aircraft, emphasizing the characteristics of each.

Baltimore

Headquarters Signal Section of the Second Army and the 69th Signal Battalion were hosts to the chapter for its opening meeting of the fall season on September 10th. A luncheon at the Officers' Club, Fort George G. Meade, was followed by a tour and demonstration of the newest type mobile signal communications equipment to be used by headquarters of field armies.

Boston

Many distinguished guests graced the head table at the first meeting of the chapter for the 1955-56 season. At the Boston Naval Shipyard in Charleston, some eighty members and guests heard commanding officers of the various major New England Armed Services installations, a preview of the 1956 national convention to be sponsored by the Boston Chapter, and remarks by National President George W. Bailey and Executive Vice President George P. Dixon.

Chapter President Gardiner G. Greene opened the meeting and Captain A. R. Taylor, Program Chairman, introduced the chapter guests as follows: Rear Adm. R. L. Ranney, Commandant Coast Guard District; Maj. Gen. Raymond B. Maude, Commanding Air Force Cambridge Research Center; Maj. Gen. E. B. Gjelsteen, Commanding General First Corps Area; Capt. J. A. Glick, Chief of Staff, First Naval District, representing Rear Adm. John Snackenberg, Commandant; Col. W. C. Heinel, Commanding Boston Army Base; and Col. Roland B. Anderson, Commanding Boston Ordnance District. Each gave a brief and interesting summary of the activities in New England of his service, its mission and its relation to communications and private industry.

National President Bailey and Executive Vice President Dixon reviewed national activities of the association, brought news from headquarters, and outlined some of the AFCEA objectives for the coming year.

Some of the Arizona Chapter officials photographed at the October 10th meeting at Fort Huachuca, left to right: Maj. Joseph Kohnstamm, membership committee chairman; Col. Harold C. Williams, nominating committee chairman; Frank A. Carollo, secretary; William E. Feist, outgoing president; Arthur Mudgett, vice president; Cyril P. McCourt, treasurer; and Willard I. Johnson, program committee chairman.

Preliminary plans for the 1956 convention were reviewed by David R. Hull, co-chairman of the convention committee. Membership Committee Chairman Robert A. Rivers reported on the encouraging increase in group and individual members during the past year.

Among those attending the meeting were members of the Northeastern University Student Chapter.

Chicago

It has become a traditional custom to hold the chapter's opening meeting each year at The Hallicrafters Company. The meeting this fall was held on September 29th, with William J. Halligan, chairman of the board of Hallicrafters and Ray H. Durst, Hallicrafters' president, acting as hosts.

The topic of the meeting was "Current Trends in Service Procurement," and was discussed by the following: John Hamlin, Small Business Advisor, Department of Defense, Washington, D. C.; Capt. L. P. Kimball, Jr., USN, Commanding Officer, Electronic Supply Office, Great Lakes; Col. LeRoy C. Lewis, USAF, Chief, Chicago Air Procurement District; and Col. A. N. Niemi, Commanding Officer, Signal Corps Supply Agency, Chicago.

At the conclusion of the program, members and guests were given an opportunity to inspect the Hallicrafters plant and facilities.

Dayton-Wright

The organizational concepts of Air Materiel areas and depots were explained at the chapter's September 22nd meeting by Col. Edwin J. Hamilton, Director of Supply and Services, Dayton Air Force Depot.

Colonel Hamilton placed particular emphasis upon the desire of the Air Materiel Command to achieve a more effective Air Force, at less cost, through improvements in both equipment and management. He also highlighted the mission of the Dayton Air Force Depot with respect to electronics.

Atlanta Chapter officers shown with National President George Bailey during his visit to the chapter on October 10th are (l to r): Charles Eberhart and Jack Evans, vice presidents; Mr. Bailey, and Col. A. R. Morley, president.

Held at the Biltmore Hotel, the meeting was preceded by a social hour and dinner.

Decatur

Mr. M. D. MacLean, Industrial Relations Manager, Caterpillar Tractor Company, was guest speaker at the chapter's first meeting of the fall season on September 29th. His subject was "The Future of Caterpillar in Decatur."

An added feature on the program was an Army film, "Operation Blue Jay —Building of Army Headquarters in Greenland."

A social hour preceded the meeting at the Decatur Signal Depot.

Fort Monmouth

Two hundred members attended the season's opening dinner-meeting at Gibbs Hall on September 29th. Featured speaker was S. Davis Page, Public Relations Supervisor of the New Jersey Bell Telephone Company who presented a lecture-demonstration entitled "Highways of Television."

Mr. Davis took the audience on a "behind the scenes" closeup of what goes on backstage to send television shows into the living rooms of American homes. He showed how a program is picked up, monitored, and routed by coaxial cable and radio relay. A miniature TV relay station was used during the demonstration.

The fall season also inaugurated a membership drive under the chairmanship of Col. Fred J. Elser who had served as president of the Augusta-Camp Gordon Chapter in 1953 when it won its second "Chapter of the Year" title.

Hawaii

Fort Shafter was the site of the chapter's first meeting of the 1955-56 season on September 21st. Following luncheon, a demonstration of tactical radio communications was presented at the Little Theater, Signal Corps Area, by Lt. Col. George P. Sunshine, Signal Officer, Hawaii Army Base Command, and a vice-president of the chapter.

During a tour of a display of various types of radio communications equipment the members and guests inspected the radio installation of the 25th Infantry Division helicopter and the AN/GRC-26A mobile radio unit.

Seated at the head table at Boston Chapter's September meeting are (l to r): Col. W. C. Heinel, Commanding, Boston Army Base; Capt. J. A. Glick, Chief of Staff, First Naval District; Maj. Gen. E. B. Gjelsteen, Commanding General, First Corps Area; David R. Hull, chapter director; National President George Bailey; Gardiner Greene, chapter president; RAdm. R. L. Ranney, Commandant, Coast Guard District; Maj. Gen. Raymond B. Maude, Commanding, Air Force Cambridge Research Center; Executive Vice President George P. Dixon, and Col. Roland B. Anderson, Commanding, Boston Ordnance District.

1 Shell leaves enemy mortar headed for U.N. lines
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Army Used Device Against Reds in Korea, NY TIMES, DEC. 12, 1954

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CHAPTER NEWS

Kansas City

Howard K. Morgan, Director of Engineering, Bendix Aviation Corporation, Kansas City Division, was the principal speaker at the chapter's October 28th meeting, held at the Advertising and Sales Executives Club.

An added feature on the program was a tour of the Trans World Airlines' automatic teletype switching center at 221 W. 10th Street, Kansas City, which was conducted at various times during the social period preceding the dinner-meeting. The system, known as an 81-D-1 System, was installed by the American Telephone and Telegraph Company and is capable of handling extremely large volumes of traffic with a minimum of operator personnel.

London

A tour of the London Airport communications facilities, arranged through the courtesy of Sir John D'Albiac, KBE, CBE, DSO, Aerodrome Commandant, featured the October 6th meeting of the London Chapter. The members and guests were conducted on the tour by Sdrn/Ldr. W. P. Nichol, AMBIRE, MIN, ARAeS, Senior Signals Officer with the Ministry of Transport and Civil Aviation, assisted by Mr. Manley, Senior Air Traffic Control Officer.

Following dinner in the airport restaurant, Sdrn/Ldr. Nichol elaborated upon the various communications facilities viewed during the tour.

An additional attraction on the evening's program was a discussion of TACAN by a representative of Standard Telephones and Cables, Ltd.

New chairman of the chapter's program committee is Captain Edward F. Metzger, USN, who was recently transferred to London from the Navy Electronic Supply Office, Great Lakes, Ill., where he had also served as a director of the Chicago Chapter of AFCEA.

New York

Austin G. Cooley, Executive Vice President of Times Facsimile Corporation, was the principal speaker at the chapter's September 29th dinner-meeting at the Hotel Shelburne.

Above, S. Davis Page (center), Bell Telephone speaker at Fort Monmouth Chapter's September 29th meeting, explains workings of miniature TV relay station to Maj. Gen. Victor A. Conrad, Fort Monmouth commanding general (left) and Col. Earle F. Cook, commanding officer, SCEL (right).

With the assistance of Paul Grafstein and K. M. McConnell, Mr. Cooley demonstrated "Radio Message Communication by Facsimile," showing the latest type equipment in operation on a local circuit on which noise was introduced to simulate actual radio conditions. The mechanical features of the apparatus were described by Mr. Grafstein and the electronic controls by Mr. McConnell. The speed and reliability of facsimile communication were discussed and demonstrated.

The numerous questions asked of the speakers at the conclusion of the meeting were indicative of the interest aroused by the program.

National President George Bailey and Executive Vice President George Dixon were present and reported on current activities of the Association.

During the business session, committee reports were presented by Henry R. Bang, membership chairman, and LeRoy Spangenberg, meetings chairman. A nominating committee was appointed by President Allen Wharton as follows: Edwin C. Carlson, chairman; Vice Adm. Walter S. Anderson and Milton G. Nattress.

North Texas

"Square Wave and Pulse Testing of Linear Systems" was the subject of the chapter's August 29th meeting at the Fort Worth General Depot Officers' Club, Mr. Bob Stuffler, field engineer of Earl Lipscomb Associates, presented the program and demonstrated his lecture with very late model test equipment including a closed circuit TV set-up. Colonel R. H. Vinding of the Depot Signal Section was host to the seventy-two members and guests present.

Tom Manning, chapter director and past president, reported on the chapter's participation in Dallas' fourth annual Engineers Banquet held in the Baker Hotel Crystal Ballroom. These banquets are sponsored by some eighteen engineering, architectural and scientific

(*Continued on page* 61)

Hawaii Chapter's September 21st meeting featured a demonstration of tactical radio communications. Photo at left shows members inspecting the radio installation of the 25th Infantry Division helicopter, and, at right, Lt. Col. George P. Sunshine, Signal Officer, Hawaii Army Base Command, demonstrates tactical radio communications equipment.

Friend or Foe?

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societies. Guests are selected Dallas and Dallas County high school seniors who have expressed an interest in engineering and scientific careers.

For this year's banquet, two hundred and fifty boys were chosen by means of aptitude and interest tests. One college scholarship was awarded at the banquet and several others were announced, and the outstanding student present from each high school received an engraved slide rule. Dr. David W. R. Morgan, national president of the ASME and vice-president of Westinghouse Electric Corp., was the principal speaker.

The AFCEA was represented by H. J. Wissemann, vice president of the North Texas Chapter and assistant vice-president of Texas Instruments, Inc., and by C. C. Batterson of Western Union, the chapter's program committee chairman, each of whom sponsored a student engineer to the banquet. The student sponsored by Mr. Wissemann, Morris Rose of South Oak Cliff High School, received the engraved slide rule for his school.

These annual Engineers Banquets were started in 1952 because of the shortage of engineers and scientists, Tom Manning advised. They offer an excellent opportunity for professional men to become acquainted with and give counsel and advice to high school students interested in the same professional field.

The Naval Air Station, Grand Prairie, was the scene of the chapter's September 29th meeting. A program of motion pictures followed dinner and a social hour. Special guests of the chapter were Lt. Cdr. Mullens, Base Electronics Officer, Naval Air Station, and Mrs. Mullens.

Paris

The Paris Chapter held a dinner meeting on the evening of September 19th at the Restaurant de l'Hermitage, Plessis-Robinson, near Paris. This beautiful restaurant is situated on a cliff overlooking a large area south of the city. Seventy-seven members and guests attended, including Maj. Gen. E. Blair Garland, Chief Signal Officer, SHAPE; Rear Adm. Joseph N. Wenger, Chief, Communications-Electronics Division, Hqs., U. S. European Command; Maj. Gen. J. M. H. Guerin, President du Comite d'Action Scientifique de Defense National, and Brig. Gen. Ivan L. Farman, Assistant Chief of Staff, Communications-Electronics, Hqs. Allied Air Forces Central Europe.

Following dinner, Chapter President Joseph R. Pernice, Chief, Electronics Division, International Staff, NATO, welcomed the guests among whom was a fair sized group representing French industry, and spoke of some of the plans for future activities of the chapter.

A short film, "Combat TV," furnished by the Paris office of RCA International, was shown. This film, which had previously been presented to American TV audiences, portrayed the utilization of TV for combat command purposes in land and amphibious warfare. The meeting was a pleasant social affair and was enjoyed by all who attended.

Philadelphia

October 13th was the date set for the first meeting of the 1955-56 season, with the Bell Telephone Company of Pennsylvania and The Diamond State Telephone Company arranging the program.

Demonstrations included long distance dialing, the solar battery, the transistor, radio relay transmission, Nike, explosion proof telephone sets, mobile telephones and many other recent developments in telephone communications.

Representatives of Prodelin, Inc., AFCEA group member company, are pictured with New York Chapter's guest speaker Austin G. Cooley, Executive Vice President of Times Facsimile Corp., and Allen E. Wharton, chapter president. Left to right are: L. A. Bondon, Prodelin president, Mr. Cooley, Col. Wharton, R. G. Maddox and A. L. Ulmann.

Pittsburgh

On September 22nd, 155 chapter members and guests met at the Totem Pole Lodge in South Park for a very pleasant afternoon and evening of good fellowship. This is the chapter's traditional opening activity of the fall season.

Those who arrived early received name badges with numbers imprinted, the members receiving white badges and the guests and new members green badges. Five excellent door prizes were distributed to the green badges who succeeded in finding a white badge with the identical number.

The afternoon events featured golf, horse shoes and volley ball. A fine buffet dinner was served by a caterer and was followed by a prize drawing for more than a dozen valuable gifts which were contributed by individuals and companies represented. Beer and snacks were provided by the chapter. Music was furnished by an accordionist and violinist who also accompanied the vocal endeavors of the various groups.

A series of diversified programs are being scheduled for the year. A membership drive was launched in September, with thirty-eight new members added to the chapter rolls during that month.

Rocky Mountain

The fourth meeting of the chapter was convened by Brig. Gen. Haskell E. Neal, chapter president, at the Fort Carson's Officers' Club on September 7th.

General Neal gave a short talk on the beginning of communications dating back to the days of smoke signals, and illustrated the advances that have been made in the field of communications by the rapidity of the notification of his recent promotion. On leave fishing at Naknek, General Neal was notified of his promotion two hours before it was made public—in order for this notification to reach him it went from Washington to Colorado Springs to Seattle to Elmendorf, Alaska, to the fishing dock, and thence by A/3C in a motorboat to the spot where he was fishing.

The results of the recent annual elections were announced by Maj. Harry W. DeWald, chairman of the election and nominating committee, as follows: president—Lt. Col. Frederick K. Nichols, ADC; vice-presidents—Lt. Cdr. James M. Blakeman, USN, CONAD; Byron E. Thady, Mountain States Telephone and Telegraph Co.; John M. McMenomey, Philco Corporation; secretary—Maj. Harvey I. Mellion, ADC; treasurer—Capt. Arthur A. Fox, ADC.

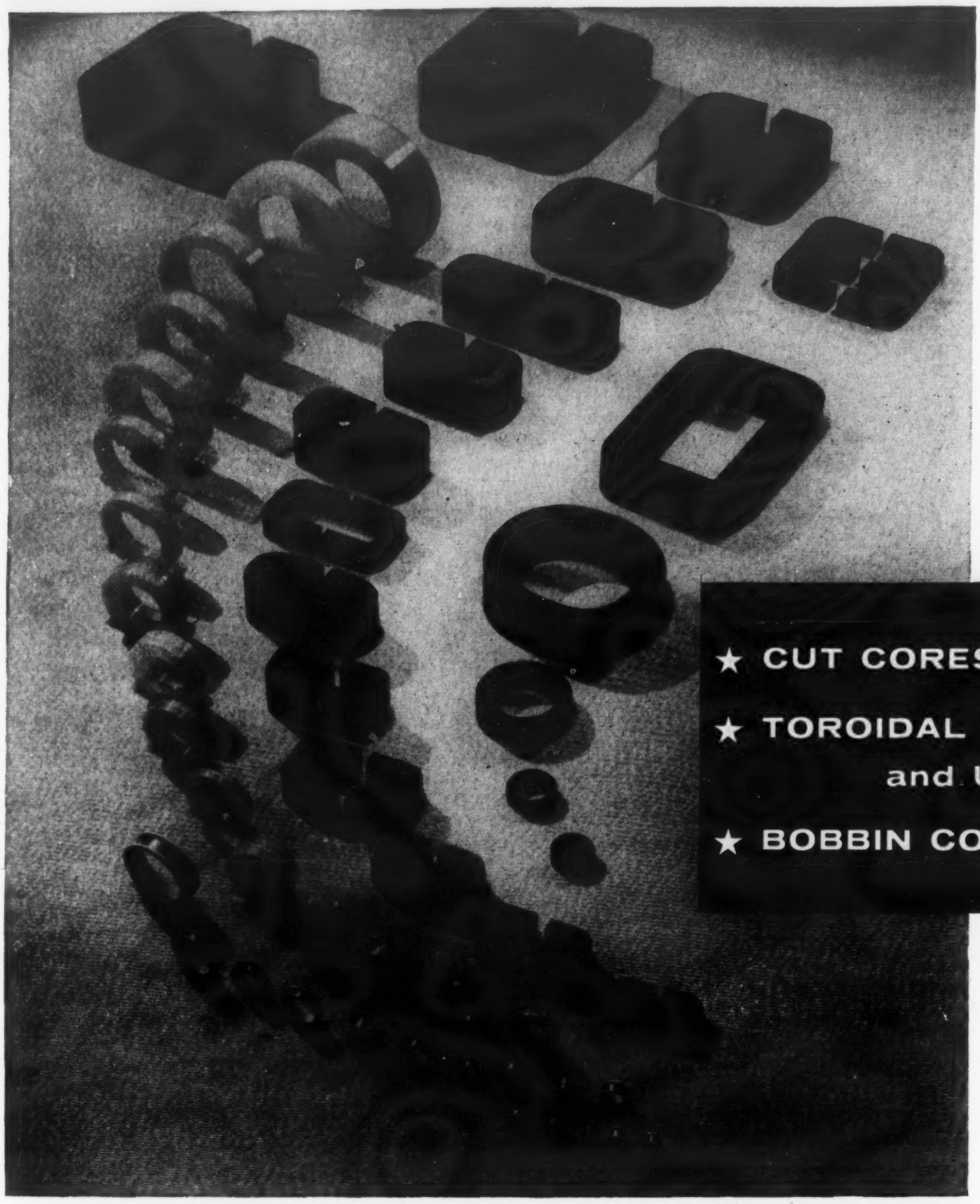
Guest speaker of the evening was Don Cline, Public Relations Division, Mountain States Telephone and Telegraph Company, who presented a lecture-demonstration on microwave relay.

San Francisco

On August 25th, the officers and directors of the chapter held a special luncheon-meeting at the San Francisco Naval Shipyard Officers' Club, with National President George W. Bailey the guest of honor.

President Bailey spoke of the origin and steady growth of the AFCEA and pointed out the many benefits derived from maintaining close liaison between the members of the Armed Forces and those in industry who have joint inter-

(*Continued on page* 63)



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ests in the fields of communications, electronics and photography. He also reported on the current activities of the association in carrying out its aims and objectives.

During the meeting, Col. Steven S. Cerwin, new Sixth Army Signal Officer, was appointed to the chapter's board of directors to replace Col. Ariel B. Cooper who has been transferred.

The San Francisco Examiner opened its doors to the chapter members on September 29th to give them an idea of what it takes to get out an evening edition. The tour through the newspaper plant included a visit through all departments from copy room to whirling presses and was acclaimed by all as being one of the most interesting meetings the chapter had enjoyed.

Prior to the tour, the members and guests met at the Camille Restaurant for a social hour and dinner.

come by Chapter President Harry L. Cooper, the members heard an up-to-date report on AFCEA affairs by Col. George P. Dixon, National Executive Vice President.

"ABC's of the FCC" was the title of a talk by Col. H. P. Niedermeyer, USAF (Ret.), Chief, St. Louis Field Office, Federal Communications Commission, at the October 7th meeting.

Colonel Niedermeyer presented a thorough coverage of the history, organization, operation and function of the FCC, and conducted a question and answer session at the conclusion of his talk.

Seattle

Regular monthly dinner-meetings were resumed on September 14th at the Seattle Elks Club. The program subject was the transmission of radio frequencies over cables, presented by M. K. Widdekind and Gordon Leach of the M. K. Widdekind Company of Seattle.

Newly installed officers of the Rocky Mountain Chapter (l to r) are: Maj. Harvey I. Mellion, secretary; Lt. Cdr. James M. Blakeman, 2nd vice president; Brig. Gen. Haskell E. Neal, outgoing president; Lt. Col. Frederick K. Nichols, new president; John M. McMenomey, 3rd vice president, and Capt. Arthur A. Fox, treasurer.

Scott-St. Louis

Some eighty members and guests gathered at Scott Air Force Base on September 9th for a base tour and a dinner-meeting at which Brig. Gen. Alvin L. Pachynski, Deputy Director of Communications-Electronics, USAF, spoke on "Industry-Military Teamwork in Communications-Electronics."

During the course of the tour, the group visited facilities of the 85th Fighter Interceptor Squadron where pilots demonstrated an alert "scramble." This squadron is charged with the protection of the St. Louis area in the event of enemy attack by air.

Other points of interest covered during the tour were the Air Force Communications Schools where airmen and officer students study the principles of radio equipment repair. The guests also saw some of the newest Air Force radar equipment.

At the Officers' Club, where the dinner-meeting was held, the AFCEA contingent was greeted by Brig. Gen. Wentworth Goss, Commanding General, Scott Air Force Base. Following a welcome by Chapter President Harry L. Cooper, the members heard an up-to-date report on AFCEA affairs by Col. George P. Dixon, National Executive Vice President.

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Colonel Niedermeyer presented a thorough coverage of the history, organization, operation and function of the FCC, and conducted a question and answer session at the conclusion of his talk.

The specific application discussed was distribution of TV signals over cable from a common receiving location in communities where signals cannot be received directly by the individual residents. It was stated that alternate channels can be distributed over the system at high levels—if adjacent channels are used, they must be transmitted at low level. Amplifiers, equalizers, branching units and various accessory units used in the system were described and shown. The equipment used in the demonstration was manufactured by the Blonder-Tongue Laboratories, Inc. of Westfield, N. J.

South Texas

Randolph Air Force Base Officers' Club was the scene of the August 16th chapter meeting which was preceded by a social hour and dinner. Brig. Gen. J. W. Persons, Wing Commander, was host and welcomed the members and guests to the base.

An interesting program was presented by Wing Operations which included a discussion of the mission of Randolph Air Force Base and a visit to the flight line for a display of the latest types of jet aircraft used by the Air Force.

The chapter took part in several activities during the month of September. On the 20th, a tour was made of the long distance facilities of the Southwestern Bell Telephone Company in San Antonio; and on the 29th, chapter members visited the display of new Signal Corps communications equipment at Fort Sam Houston, which included new field telephone systems, switchboards, carrier apparatus, attended and unattended repeaters, radio equipment and teletypewriter systems.

Southern California

To develop the relationship between its photographic and electronics groups, the chapter featured an elaborate presentation by the Lookout Mountain Laboratory of the Air Force Motion Picture Service at its October 4th meeting.

Report of the meeting had not been received as SIGNAL went to press.

Southern Connecticut

Chapter members and guests kicked off the fall-winter series of monthly meetings on September 15th with an informal get-together which featured a talk on "The Place of the Independent Research Laboratory in Industry and Defense" by Lincoln Thompson, Vice President of Raymond Engineering Laboratories. The subject prompted considerable audience interest and discussion.

Mr. Thompson reported that $4 billion was spent in 1954 on basic research; of this $600 million was sublet to outside non-captive laboratories doing up to $9 million business and on the average $2 million per year. Due to the increasing complexity of engineering development, particularly in defense applications, the importance of the independent engineering laboratory is helpful with reference to (a) peak engineering loads, (b) specialized engineering, (c) more efficient production, (d) product modification. Mr. Thompson pointed out that the independent engineering laboratory goes beyond the field of consulting by assuming responsibility for completion of the project just as an integral part of the engineering department of the contractor.

The typical laboratory, the speaker said, has facilities for research and development, model making, and production. About one-half of the value of Service contracts is in research and development, the other half in production. On civilian end-use jobs, nearly all of the billing is for research and development.

Col. Edgar Love, chapter president, directed the meeting and reported on the past national convention. Membership Chairman I. T. Shapiro emphasized the mutual benefits of renewals and asked for assistance through personal contacts in lining up membership prospects.

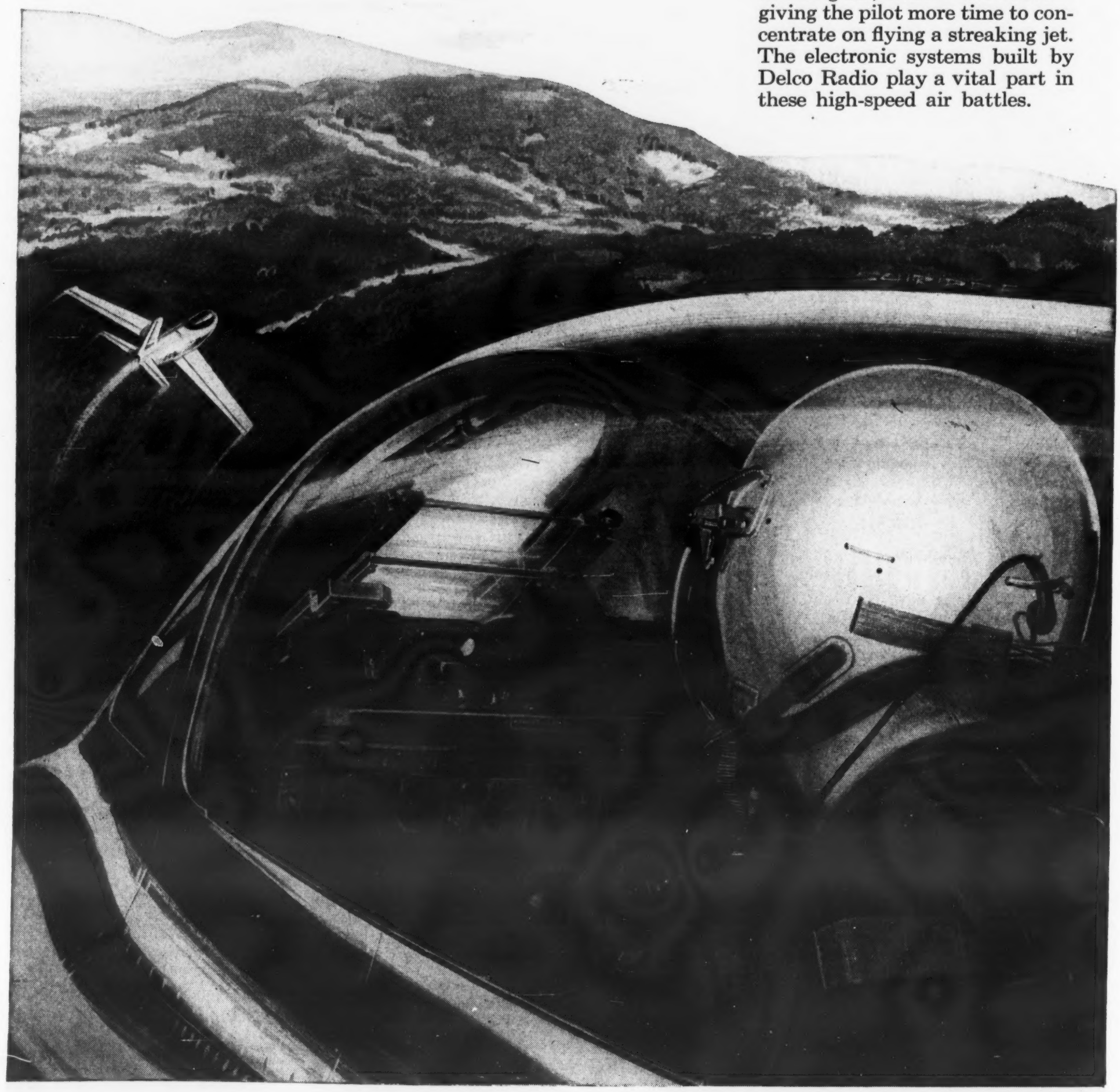
Sidney L. Rosenberg, co-chairman of

(*Continued on page* 66)

Guns that aim

DELCO SKILL DOES IT!

The pilot guides the plane; the electronic system of the A-4 fire-control unit tracks the target, day or night, for automatic fire control of guns, bombs or rockets—giving the pilot more time to concentrate on flying a streaking jet. The electronic systems built by Delco Radio play a vital part in these high-speed air battles.

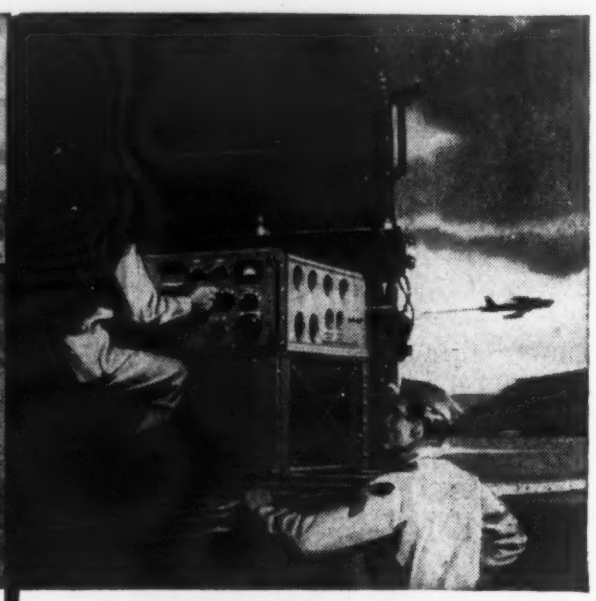


themselves

DELCO RADIO HELPS BUILD—

T-38 SkySweeper, self-aiming anti-aircraft gun.

AN/TRC-32 transportable control towers for airfields.



R-390 all-purpose receiver for the Army Signal Corps.

Delco Radio's experience and manufacturing skill are contributing to the low-cost production of radio, radar and electronic systems for military equipment.

Delco Radio has at its command the largest integrated manufacturing facilities in the electronic field, so that it is able to produce from raw materials to finished product, more economically than ordinary assembly subcontractors.

This "under one roof" manufacturing offers purchasers still other advantages—coordinated scheduling, uniform product quality, and on-time delivery.

Delco Radio is ready *now*. For low-cost on-time production of electronic systems of high uniform quality, see Delco Radio.

DELCO RADIO
DIVISION OF GENERAL MOTORS
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DELCO RADIO HAS BUILT

PULSED GLIDE PATH LANDING EQUIPMENT
TAIL WARNING RADAR
NAVIGATIONAL DRIFT INDICATORS
ENGINE DETONATION INDICATORS
OXYGEN FLOW INDICATORS
LORAN RADIO RECEIVERS
AM AND FM RADIO RECEIVERS AND TRANSMITTERS
RADAR COUNTERMEASURE EQUIPMENT
RAZON BOMB CONTROLS
RT-70 RECEIVER-TRANSMITTERS
M-403 PROXIMITY FUSES
R-390 ALL-PURPOSE RECEIVER COMPONENTS

DELCO RADIO IS BUILDING

A-4 GUNSIGHT-ROCKET AMPLIFIERS
T-38 SKYSWEEPER ELECTRONIC SYSTEMS
AN/TRC-32 TRANSMITTER-RECEIVER FOR CONTROL OF AIRFIELDS
AN/GRC-27 TRANSMITTER AND RECEIVER

DELCO RADIO CAN HELP YOU BUILD

VEHICULAR COMMUNICATION EQUIPMENT
TRANSMITTERS AND RECEIVERS
AIRBORNE COMMUNICATIONS—RADAR
PACK OR PORTABLE COMMUNICATIONS EQUIPMENT
ELECTRICAL COMPONENTS
ELECTRONIC CONTROLS FOR GUIDED MISSILES

the chapter's Civil Defense committee, was applauded for his work in connection with the setting up and maintaining of communications after the Diane Hurricane flood disaster. Mr. Rosenberg, radio officer for Civil Defense in New Haven, had been appointed Deputy Director of Civil Defense by the Mayor of New Haven and spent two weeks' full time duty coordinating communications and activities throughout the flood area, particularly in Waterbury and Winsted. He supervised the construction of communications equipments and the revamping of transmitters borrowed from radio hams. Mr. Rosenberg is with the Signal Corps Supply Agency and was on two-week leave of duty to permit his full-time participation in this emergency activity.

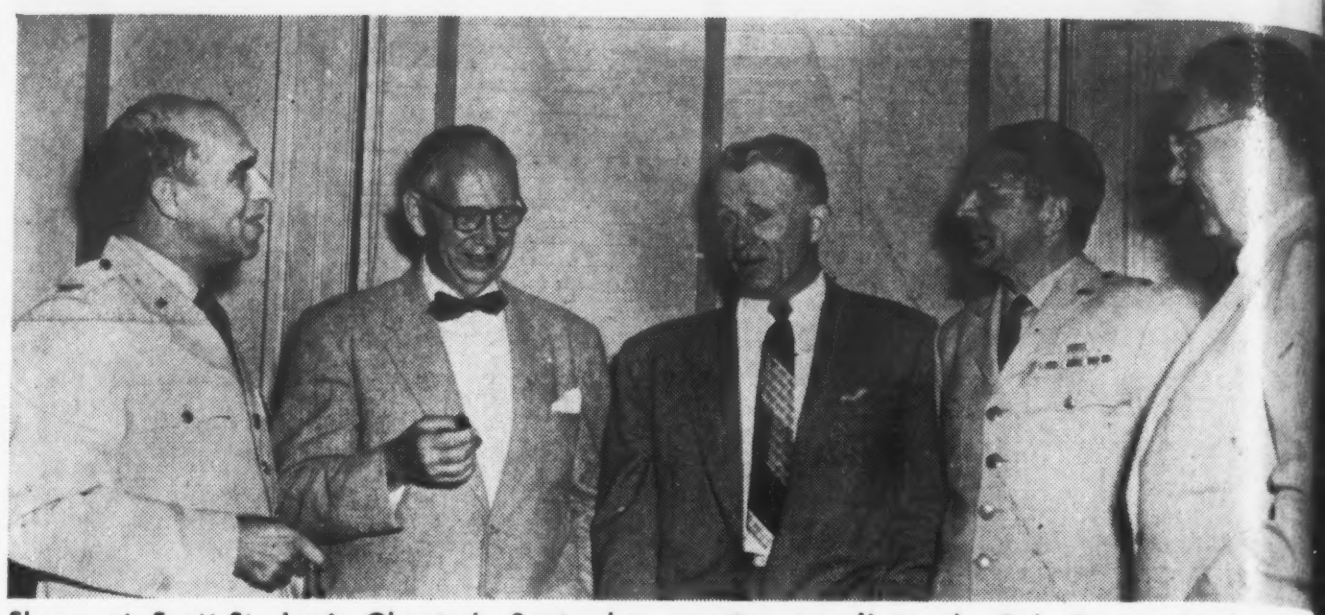
Southern Virginia

Lt. Col. Melvin M. Lawson, Hq. CONARC, Fort Monroe, was elected president at the chapter's annual elections on August 20th. The other new officers are: vice-presidents — William W. Beerbower, Post Signal Div., Fort Eustis; Samuel A. Benson, Philco Corp.; J. Rhodes Mitchell, Chesapeake & Potomac Telephone Co.; Cdr. Charles B. Murray, Hqs. Fifth Naval District; and Lt. Col. Gilbert M. Payne, C. D. Gp., CONARC; treasurer—Maj. Jack A. Albright, SigSec, CONARC; secretary—Gerald R. Sauer, RCA Service Co., Inc.; assistant secretary—Frank H. Jeys, Philco Corp.

The dinner-meeting was held in the Williamsburg Room of the Langley Air Force Base Officers Club, with fifty-six members and guests present. The program feature was the General Electric film "A is for Atom," which was found to be most informative and interesting.

Tinker-Oklahoma City

On October 10th, the chapter joined with the American Institute of Electrical Engineers and the Institute of Radio Engineers in sponsoring a lecture-demonstration on "The Principles of Color Television" by Cyril N. Hoyler, Manager, Technical Relations for the David Sarnoff Research Center of RCA.



Shown at Scott-St. Louis Chapter's September meeting are (l to r): Col. Gomer Lewis, Dir. C&E, Hqs ATC; Col. George P. Dixon; Chapter President Harry L. Cooper; Brig. Gen. Alvin L. Pachynski, Deputy Director of Communications-Electronics, USAF, principal speaker, and John M. Black, Operating Vice President, Southwestern Bell Telephone Co.

Mr. Hoyler traced the history of color television and referred to some of the early technical advances which are significant today. He illustrated the principles of color formation pertinent to television and described ways in which a color television signal may be transmitted. A simultaneous color television system produces high quality pictures but does not meet the requirements of a 6-mc. channel and compatibility with the black and white system. Discussion revealed how the basic simultaneous system was modified to meet these requirements through more efficient use of the video channel and by taking into account the characteristics of human color vision.

The meeting was held in the auditorium of the YWCA, Oklahoma City, and drew an attendance of 150 persons. Col. S. A. Mundell, first vice-president of the Tinker-Oklahoma City Chapter, presided for the AFCEA.

Tokyo

The chapter's opening meeting of the fall season was scheduled for October 13th with the Navy as host at Yokosuka Naval Station. Principal speaker at the luncheon was Admiral Robert F. Hickey, Chief of Staff, Commander Naval Forces Far East.

(Details of meeting had not been received as SIGNAL went to press.)

Prior to the Scott-St. Louis dinner-meeting on September 9th, members and guests were conducted on a tour of Scott Air Force Base. Here a group watches T/Sgt. Jack E. Binkerd, an instructor in the Ground Radio Training Branch of the Air Force Communications School, demonstrate the operation of a Globecom Transmitter.

Washington

A crowd of three hundred and fifty persons turned out for the chapter's opening meeting of the fall on October 6th to hear Capt. Rawson Bennett, USN, Assistant Chief, Bureau of Ships, Electronics, present a special report on the USS *Forrestal*. Captain Bennett's report was of such interest to the Washington group that it is printed on page 34 of this issue for the benefit of all AFCEA members.

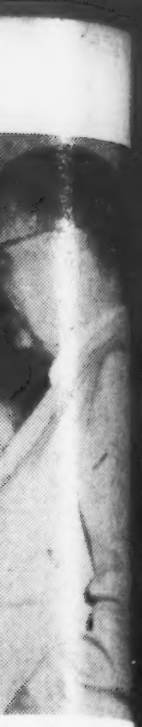
The luncheon-meeting was held in the spacious new ballroom of the Willard Hotel where there are ample facilities to take care of the ever-increasing attendance at these Washington Chapter meetings.

Distinguished guests at the head table were: Rear Adm. Richard M. Watt, Jr., Chairman, Naval Industrial Plant Review Board; Rear Adm. H. C. Bruton, Director of Naval Communications; Rear Adm. Armand M. Morgan, Asst. Chief, Bureau of Ships for Ship Design and Research; Rear Adm. Bernard E. Manseau, Deputy and Asst. Chief, Bureau of Ships; Rear Adm. R. E. Dixon, Asst. Chief, Research and Development, Bureau of Air; Rear Adm. Frederick R. Furth, Chief of Naval Research; Rear Adm. A. G. Mumma, Chief, Bureau of Ships; Capt. G. T. Mundroff, Acting Vice Chief, Office of Naval Materiel; Capt. Robert B. Kelly, Chief, Standards and Curriculum, Bureau of Personnel; Capt. Peter V. Colmar, Chief, Electronics Division, U. S. Coast Guard.

Chapter News Deadline

Chapter secretaries and publicity chairmen please note that the deadline for Chapter News is the 5th of the month preceding the first named month of each issue—i.e., December 5th for the January-February issue, etc.

Therefore, to have your news appear in the earliest possible issue of SIGNAL, please send in your material promptly.



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PROBLEM: GRAVITY

Interested in it? So are we!

For part of the work in advanced design at Martin includes an overall search into the basic laws of the universe—probing the unknown in every field that relates to airborne systems.

As a result of this far-reaching program of exploration—which includes the establishment of an independent laboratory for pure and advanced research—exciting new long-range developments have created exceptional opportunities at Martin on projects of the highest priority and importance.

Opportunities such as these are an engineer's dream!... If you are one of the many creative engineers who are lost in large organizations, anchored to static, non-creative jobs—ceiling zero, visibility zero—you'd do well to look into the Martin story.

MARTIN
BALTIMORE

ITEMS OF INTEREST

From Government, Industry and the Services

Automatic Air Defense Through Electronic Brain

Planes equipped with an electronic brain have shifted aerial combat advantage from the offense to the defense, it was revealed recently when the Hughes Aircraft Company unveiled its new electronic fire control system developed for the Air Force.

Every interceptor plane in America and Canada in the Air Force Continental Defense Command is equipped with this fire control system. The brain's radar equipment picks up the enemy plane, puts the defending interceptor on target, automatically fires when it is within range, and then returns the defending aircraft to its base.

The system, which combines radar receiver-transmitter equipment with a computer, is synchronized with the plane's controls, and armament occupies only 29 cubic feet when installed.

HUMAN VOICE BROADCASTS ITSELF

The human voice has been put to work at the Signal Corps Engineering Laboratories and made to radio broadcast itself.

Speech waves sent out by the Signal Corps' voice-run radio are studied on a scope by George Bryan, designer of the experimental device.

Only the natural sound waves themselves are needed to power a radio transmitter small enough to fit inside a telephone mouthpiece. As long as the sender speaks, the radio works and his voice is broadcast.

This new device does not need any added power such as ordinary radios get from batteries or other sources. A unique technique using a single transistor and matched circuit makes it possible for the new transmitter to harness the speaking voice.

Still an experimental device, this transmitter, which could be produced for about $20.00, has already broadcast the voice more than 600 feet. With higher radio frequencies and matched antenna, the distance is expected to increase up to a mile.

Further development is also expected to lead to a companion radio receiver weighing only three ounces to be powered by the same voice energy. This would be built up and stored in the set when sending, and later used for receiving.

Although not yet ready for a soldier's use on the battlefield, the new device with added refinement may greatly benefit both civilian and military users. With no need for batteries, size and weight of Army walkie-talkies and hand-held tactical radios could be cut in half and permanently sealed in plastic containers to keep out dirt and moisture.

Printing Telegraph Signal Normalizer Developed

A new device called a Printing Telegraph Signal Normalizer has been developed recently by the Department of Defense.

This device makes possible the transmission of time-synchronous tele-printer signals through a channel of time-synchronous radio or cable multiplex without requiring mutual synchronization between the two systems.

In time-synchronous teleprinter systems, the speed of the receiving teleprinter is continuously governed by a frequency standard the rate of which is corrected against drift by a servo that senses the average character rate of the received signals. Therefore, the multilation of a single traffic pulse has negligible effect on the speed of the receiving tele-printer and fewer garbles occur.

Another important advantage of time-synchronous teleprinter systems is that they preserve the character count; that is, the receiving equipment functions precisely as many times per hour as does the transmitting equipment, regardless of circuit noise or circuit failure.

Two versions of the Printing Telegraph Signal Normalizer have been developed. The TSEC/HW-1 is an electro-mechanical device occupying about 26 inches of rack space. The TSEC/HW-2 is a wholly electronic device occupying about 24 inches of rack space.

AUTOMATION DISCUSSED BEFORE CONGRESSIONAL COMMITTEE

Two representatives of the electronics industry recently appeared before the Subcommittee on Economic Stabilization of the Joint Congressional Committee on the Economic Report.

Don G. Mitchell, Chairman and President of Sylvania Electric Products Inc., and Robert C. Tait, President of Stromberg-Carlson Co., Division of General Dynamics Co., reached the conclusion that application of automation techniques must be increased. They emphasized that automation will enable future American industry to produce goods for an expanding population with higher purchasing power.

Mr. Mitchell reported that production for half the yearly requirements for radios could probably be met by a fully automatic assembly line operated on an eight-hour day but, all sets would be alike and would meet with consumer resistance. Demand for different styles and types of receivers tends to confine automatic assembly to common components and sub-assemblies used in different style receivers. He also stated that the advances in automatic assembly techniques of the tube industry have resulted in higher quality products.

Mr. Tait reminded the group that "we need to be more concerned about the availability of human engineering talent than we need be about the impact of automation."

Work Begins on Project Vanguard

Project VANGUARD is the name assigned to the scientific satellite project previously announced this year to conduct upper atmosphere research during the forthcoming International Geophysical Year, July, 1957-December, 1958.

The Glenn L. Martin Company of Baltimore, builders of the Viking rocket for the Navy, has been awarded

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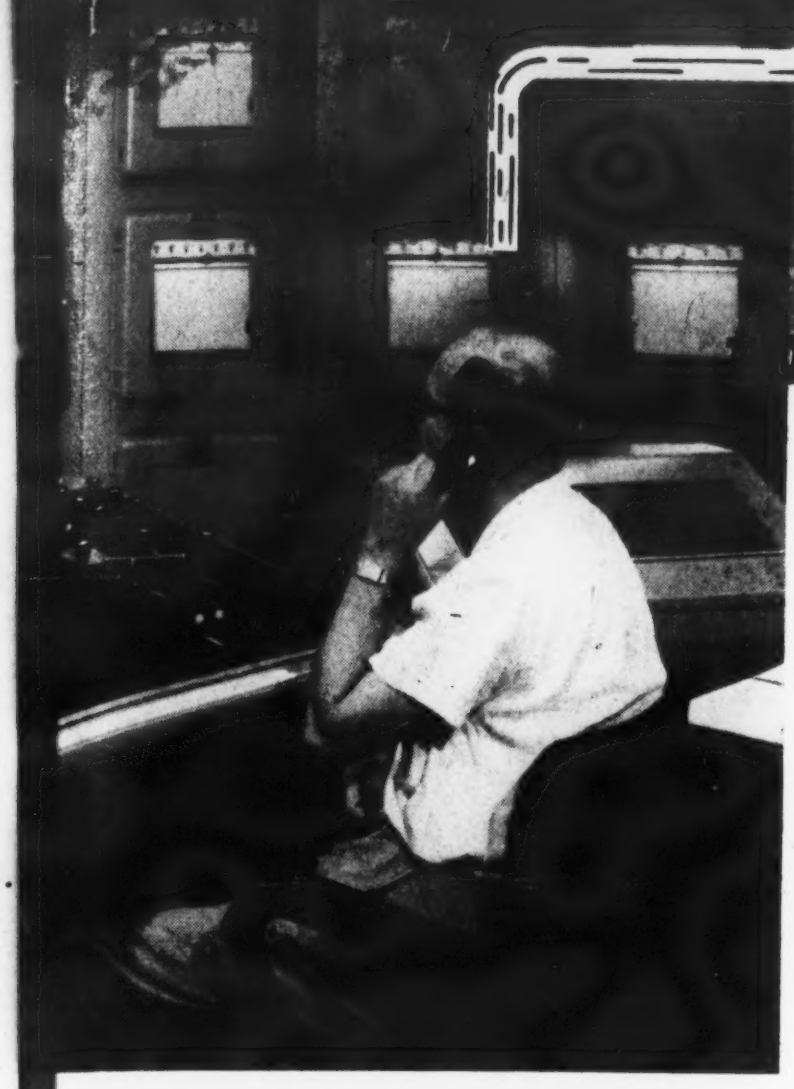
MOTOROLA MICROWAVE



improved operations

ECONOMICAL . . . the most economical type of multi-channel communication.

EASY TO EXPAND . . . channels can be inexpensively added.

WEATHERPROOF . . . the most reliable in snow, ice, rain, and high winds.

VERSATILE . . . spans rivers, swamps, mountains, and city streets with ease and is virtually unlimited in length.

PRIVATE . . . owner has complete control over communications at all times, and narrow beam assures private communication.

The dynamic power utility industry is increasing the emphasis on automation, data transmission, and centralized control to obtain better protection of personnel and property, better service, and more efficient operation—and microwave is providing the necessary communications. Motorola microwave systems are transmitting intelligence via telephone, telegraph, teletypewriter, telemeter, supervisory control, facsimile, television and many other devices.

Thousands of miles of Motorola microwave systems have been working dependably over the years in the power utility industry. This acceptance and experience means engineering and production "know how"—equipment which performs better, lasts longer, and costs less to maintain. These extra dividends repeatedly appear in operational records of Motorola microwave users.

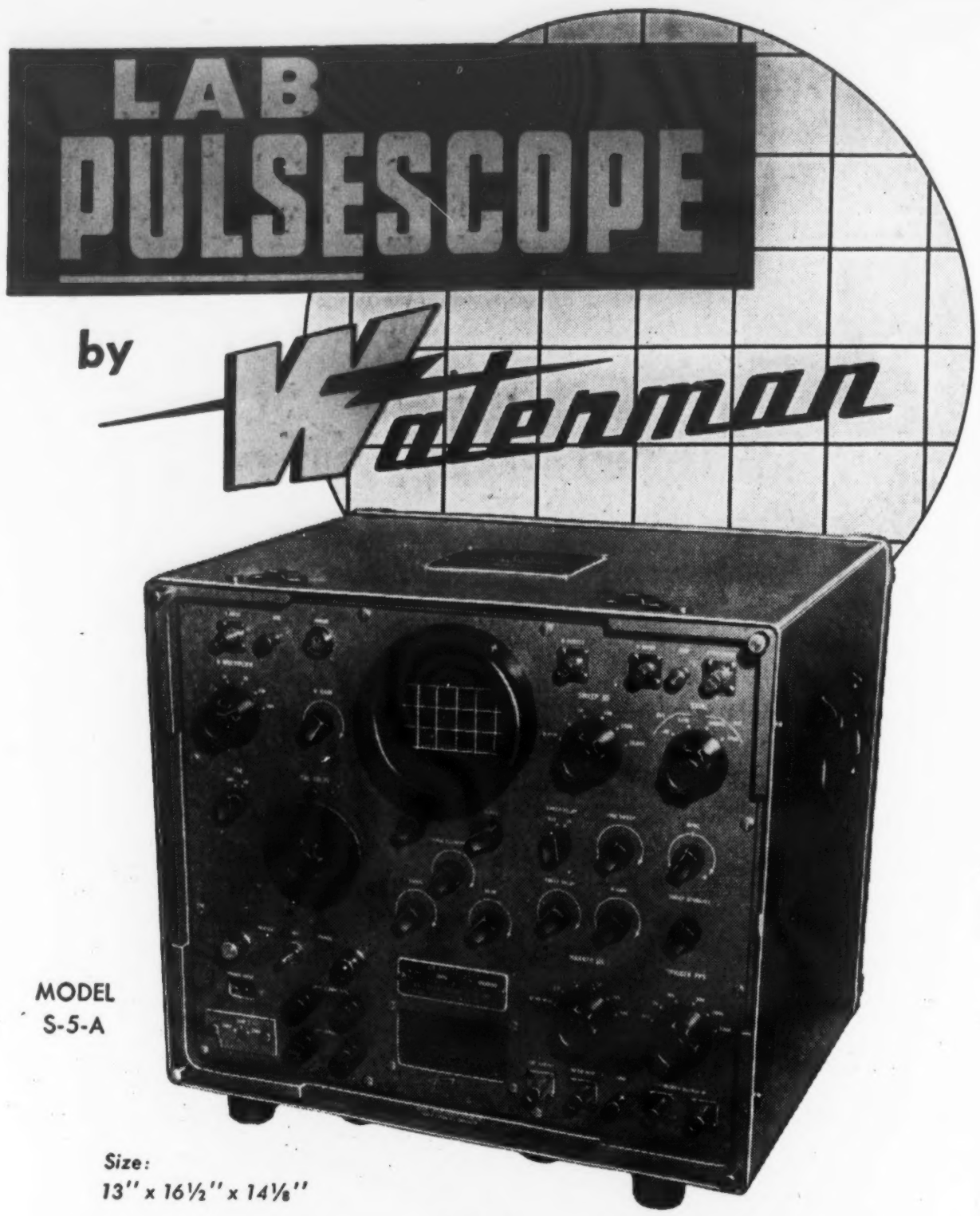
Partial list of systems operating in the power utility industry

Bonneville Power Administration
Brazos Electric Power Co-op.
Central Illinois Public Service Co.
Cleveland Electric Illuminating Co.
Dayton Power and Light Co.
East Kentucky RECC*
Idaho Power Co.*
Illinois Power Co.
Kansas Power and Light Co.*
Kentucky Utilities Co.
Middle South Utilities Co.
Modesto Irrigation District
Northern Indiana Public Service Co.*
North West Electric Power Coop.
Ohio Power Co.
Pacific Power and Light Co.
Puerto Rico Water Resources Authority
San Antonio Public Service Board
Southern California Edison Co.
Southern Counties Gas Co.
Texas Electric Service Co.
**Under Construction*

THE COMPLETE SUPPLIER OF RADIO COMMUNICATIONS

MOTOROLA

Motorola Communications & Electronics, Inc., 4501 A



MODEL
S-5-A

Size:
13" x 16½" x 14⅛"

ANOTHER EXAMPLE OF *Waterman* PIONEERING . . .

The LAB PULSESCOPE, model S-5-A, is a JANized (Gov't Model No. OS-26) compact, wide band laboratory oscilloscope for the study of all attributes of complex waveforms. The video amplifier response is up to 11 MC and provides an equivalent pulse rise time of 0.035 microseconds. Its 0.1 volt p to p/inch sensitivity and 0.55 microsecond fixed delay assure portrayal of the leading edge when the sweep is triggered by the displayed signal. An adjustable precision calibration voltage is incorporated. The sweep may be operated in either triggered or repetitive modes from 1.2 to 120,000 microseconds. Optional sweep expansion of 10 to 1 and built-in markers of 0.2, 1, 10, 100, and 500 microseconds, which are automatically synchronized with the sweep, extend time interpretations to a new dimension. Either polarity of the internally generated trigger voltage is available for synchronizing any associated test apparatus. Operation from 50 to 400 cps at 115 volts widens the field application of the unit. These and countless additional features of the LAB PULSESCOPE make it a MUST for every electronic laboratory.

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S-4-C SAR PULSESCOPE®
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S-11-A INDUSTRIAL POCKETSCOPE®
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S-15-A TWIN TUBE POCKETSCOPE
RAYONIC® Cathode Ray Tubes
and Other Associated Equipment

ITEMS OF INTEREST

the prime contract for a major part of the project, the rocket launching vehicle. The General Electric Company will supply the rocket motor which will be used in the first stage of the launching vehicle, and other important portions of the launching vehicle will come from different companies.

Although the exact shape and size of the satellite itself have not yet been determined, it will be large enough to contain a number of instruments and to be tracked from the ground by optical and radio devices.

The Defense Department's participation in Project VANGUARD will be accomplished as a joint Army-Navy-Air Force program under Navy management.

IONOSPHERIC SCATTER PERMITS LONG DISTANCE COMMUNICATIONS

A phenomonon known as forward propagation by ionospheric scatter (FPIS) permits reception of directional signals over distances between 500 and 1,500 miles.

Because of the increased interest in the Arctic and far North, and because it has been heretofore impossible to establish radio service in these regions with high or low frequency techniques, the use of ionospheric scatter becomes a necessity.

Although much of the information is still classified, the Air Force has recently released information about Project BITTER SWEET.

An Air Force project completed in 1953, Project BITTER SWEET is a four-channel duplex radio teletype system linking Loring AFB, Maine, with Thule AFB, Greenland, via relays at Goose Bay, Labrador, and Sondrestrom, Greenland. Performance of the scatter technique in this system has indicated that it will be extended over other communication routes.

Project BITTER SWEET was engineered by the National Bureau of Standards, and the equipment was installed by Page Communications Engineers, Inc., of Washington, D. C.

A high degree of reliability and conservation of frequencies are the tremendous advantages of communication by ionospheric scatter.

Although engineers feel that the potentialities of FPIS have not yet been fully explored, the importance of this technique is attested to by the October special issue of the *Proceedings of the IRE* on scatter propagation.

(*Continued on page* 72)

Business tragedy . . . she just hung up on the firm's best customer!

It could happen to any secretary. The boss wandered off without telling her where. Then Mr. Big called. So the girl looked for her boss in three other offices, returning each time to report. Then, as she started her fourth scouting trip, she unthinkingly hung up the 'phone!

Not exactly a world-shaking catastrophe, but there ought to be some way of avoiding it—especially when you think that the party cut off might have been on the verge of okaying a really big deal.

Such a situation need never occur to *you,* if your business were located in a community using Stromberg-Carlson telephones, and you were leasing a wonderful new development which we call our "6K System."

This is an ingenious combination of electrical relays, a power supply and the telephone instrument shown at the left—a desk-type with six special keys on it. Anybody with such a 'phone can originate or answer "outside" calls, *hold* calls on any line, intercommunicate within the premises and even signal co-workers by buzzer.

The secretary above, for instance, would have answered the call from the customer on Line 1, *held* the call by pressing the Hold key, used the intercom facilities to call around the building and—when she finally located her man, he'd simply pick up the nearest telephone, press key number 1 and be automatically connected with his client.

We take this sort of pains to solve the little problems of business efficiency. We have often applied the same ingenuity to problems of Uncle Sam.

There is nothing finer than a

Stromberg-Carlson®

Radio, TV and High Fidelity Equipment

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ITEMS OF INTEREST

Bell Labs Inaugurates Solar Power for Rural Telephones

On Tuesday, October 4, 1955, Bell Telephone Laboratories' engineers switched solar power into a new type of rural telephone system using the Bell Solar Battery developed by Bell scientists last year.

Use of solar power is a part of experiments being conducted near Americus, Georgia, to develop more and better rural telephone service.

The solar battery has no moving parts or corrosive chemicals and therefore should last indefinitely. Excess current from the solar unit not needed for immediate telephone use feeds into a storage battery which provides power at night and over periods of bad weather. Even in poor light, it will continue to charge the storage battery but at lower power.

The new system uses the "carrier" principle which allows several conversations to be sent simultaneously over a single pair of wires. Since each conversation is sent at a different frequency, they do not interfere with each other.

Silicon cells used in the battery can convert as much as 11% of the energy they receive from the sun directly into electrical power—a performance comparable to that of the best gasoline and steam engines.

Since the device is still very new, its practical future use is difficult to predict, but Bell scientists think that it might be used economically for communication purposes where commercial power is unavailable and where small amounts of power are sufficient.

For the first time, the sun is furnishing power directly to a telephone line. A Southern Bell Telephone Company cable repairman is shown adjusting the solar-powered device to pick up the prevailing light. It will furnish power even in poor light.

Air Force Procurement Story Available on Film

"The Air Force Procurement Production Story," a sound, color motion picture on the buying procedure of airplanes is now ready for release by the Air Materiel Command.

Narration and animation, interspersed with live photography, trace the airplane buying program from its inception at Department of Defense level, through the Joint Chiefs of Staff, to the Air Research and Development Command and Air Materiel Command until the plane is finally delivered.

Running 26 minutes, the picture gives special emphasis to the organization of the Procurement and Production Directorate. A detailed, yet simple, explanation of the Weapons System method of procurement is also included in the picture.

Organizations interested in seeing the movie should contact the nearest Air Materiel Area or Air Procurement District, or should communicate directly with the Commander, Air Materiel Command, Attention: Contractor Relations and Industrial Liaison Branch (MCPAC) Management Services Office, Directorate of Procurement and Production, Wright-Patterson Air Force Base, Ohio.

Recommendation to Standardize Testing of Electronic Relays

A recommendation that the Armed Services Electro-Standards Agency be given the authority and personnel to standardize specifications and procedures for testing electronic relays was made by the Electronic Relays Industry Advisory Committee.

Meeting with officials of the Business and Defense Services Administration, U. S. Department of Commerce, and other Government agencies, industry spokesmen expressed concern over what they considered a lack of uniform specifications and testing procedures for the three Services.

A Committe member stated that, in the absence of guidance from the Government, equipment manufacturers have established their own quality control requirements for relays. This, he added, has often resulted in "testing" much of the life out of a product before it is ever installed in equipment.

It was stated by a Committee spokesman that industry could provide a better product if given the actual operating requirements for relays instead of specifications with unknown safety factors built into them.

Relay production capacity represents one of a group of studies planned by BDSA's Electronics Division in cooperation with industry and the Department of Defense.

Aviation Firm to Manufacture Printed Circuits

Curtiss-Wright Corporation of Wood-Ridge, New Jersey, has been granted a license to manufacture printed electrical circuits by Technograph Printed Electronics, Inc., Tarrytown, New York, holder of basic patents for producing printed circuits.

The aviation firm thus becomes the first major company in that industry to use printed circuits under license in the production of electronic and electrical equipment for aeronautical use. First application of printed circuitry is expected to be in the production of flight simulators.

Because of the importance of the process in simplifying construction, improving performance, reducing cost, and saving space and weight, Curtiss-Wright will look into the application of printed circuitry in all of its electronic end electrical developments including de-icers for engines and the replacement of hand-wired circuits in other units.

Signal Corps Interference Reduction Group Formed

In an effort to provide optimum assistance to the Technical Services of the Department of the Army and their contractors, the Signal Corps Engineering Laboratories, Fort Monmouth, New Jersey, has established a Radio Interference Suppression Group at the SCEL West Coast Office in Pasadena, California.

(*Continued on page* 74)

WHY THIS SIGN IS YOUR GUIDE TO FINER TELEVISION

RCA's 36 years' experience is yours to share in TV—black-and-white or color

When the time comes for you to purchase a TV set and enjoy the most fabulous medium of entertainment ever created for the home, here are facts that will help you make the right decision.

To pioneer and develop television, in color as well as in black-and-white, called for a special combination of practical experience, great resources and research facilities in the fields of communications and electronics.

RCA was well qualified to do the job:

EXPERIENCE: RCA has been the recognized leader in radio communications since its formation thirty-six years ago. Its world-wide wireless circuits, established in 1919, and its development of electron tubes, laid the groundwork for radio broadcasting in 1920 . . . and the first nationwide radio network in 1926.

Radio broadcasting led to television—and in 1939 RCA made history by introducing black-and-white TV as a service to the public.

Dr. V. K. Zworykin of RCA invented the Iconoscope, or television camera tube, and he developed the Kinescope, now universally used as the picture tube.

RESOURCES: Pioneering and development of color TV has been one of the most challenging and expensive projects ever undertaken by private industry. To date, RCA has spent $50,000,000 on color TV research and development, in addition to the $50,000,000 previously spent in getting black-and-white TV "off the ground" and into service.

RESEARCH FACILITIES: RCA has one of the most complete, up-to-date laboratories in the world—the David Sarnoff Research Center at Princeton, N. J. It is the birthplace of compatible color television and many other notable electronic developments.

No wonder that you can turn to RCA to find all of the essentials of quality and dependability born only of experience.

In addition, the RCA Service Company, manned by a corps of trained technicians, operates service branches in all principal television areas. No other organization is so thoroughly equipped to install and service your television set, as well as any other RCA product.

RADIO CORPORATION OF AMERICA

Electronics for Living

RCA®

ITEMS OF INTEREST

With the establishment of this West Coast facility, there are now available three Signal Corps Suppression Centers in the United States, the other two being located at Fort Monmouth and Milwaukee.

Each of the centers is equipped to perform radio interference suppression investigations on the following equipment being procured by the Department of the Army: vehicles and vehicular sub-assemblies; electronic and electrical equipment; engine generators and miscellaneous engines; railway rolling stock; and watercraft.

In addition to performing qualifying suppression investigations, engineering personnel are available to provide consultation service to any Government agency or contractor on any radio interference reduction problem arising as a result of procurement, manufacture, and maintenance of Army equipment.

There are now 16 mobile laboratories making on-the-spot tests to determine conformance to applicable suppression specifications. These labs are 29-passenger buses which transport test equipment and associated gear to all parts of the country.

Ceramics for Piezoelectric Transducers

The National Bureau of Standards has developed several lead-oxide based piezoelectric ceramics that have excellent electromechanical properties and are suitable over a wide temperature range.

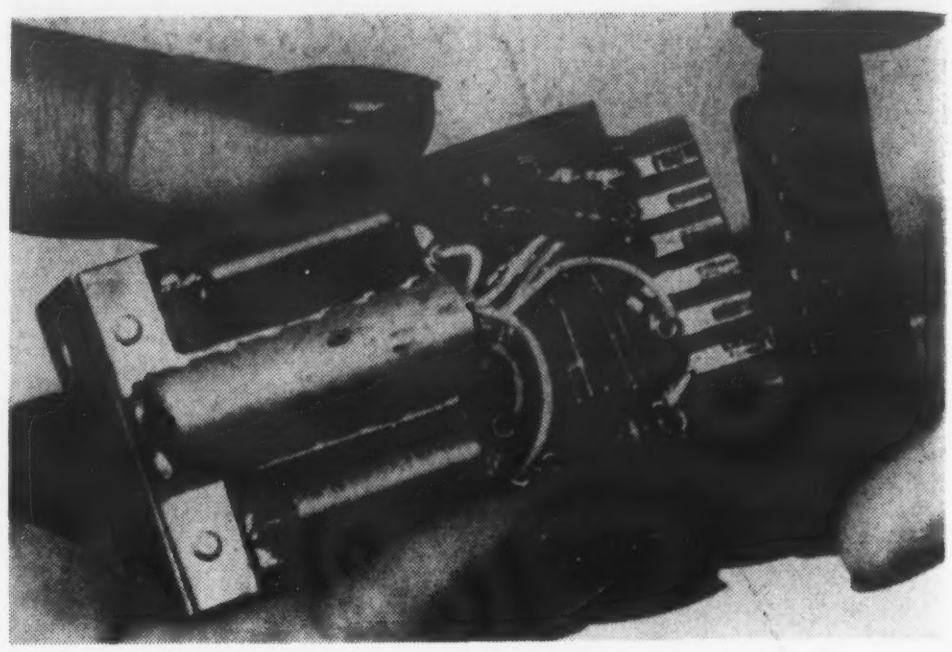
Some of these compositions are expected to find considerable application as transducers for sensing elements in accelerometers, sound detectors, sonar, velocimeters, strain and pressure gauges, and as drivers in ultrasonic devices. These materials can be expected to replace barium titanate in many commercial applications and to extend the use of ceramic transducers. The compositions were developed by B. Jaffe, R. S. Roth, and S. Marzullo of the Bureau's mineral products laboratories under the sponsorship of the Army's Office of Ordnance Research.

Piezoelectric ceramics are widely used as transducers for energy conversion between electrical signals and mechanical motion. To overcome the narrow temperature limitations of barium titanate, the Bureau developed lead-oxide based ceramics of particular compositional ranges having a response that is uniform over a much wider temperature interval.

Because of high voltage coefficient, lead titanate-lead zirconate ceramic is particularly adaptable as a sensing element to convert mechanical motion.

Helicopter's Flight Control

An electronic "brain cell" is the basic building block unit for the master amplifier of a new flight control system for helicopters developed by Sperry Gyroscope Company. Interchangeable miniature units plug into a compact block of sockets to form a complete amplifier.



World's Smallest Magnetron Tube Developed by Signal Corps

The world's smallest continuous wave, self-contained magnetron tube —a must for developing small mobile radar sets that can be carried by troops in fox holes to warn against approaching tanks—has been developed at the Signal Corps Engineering Laboratories, Fort Monmouth.

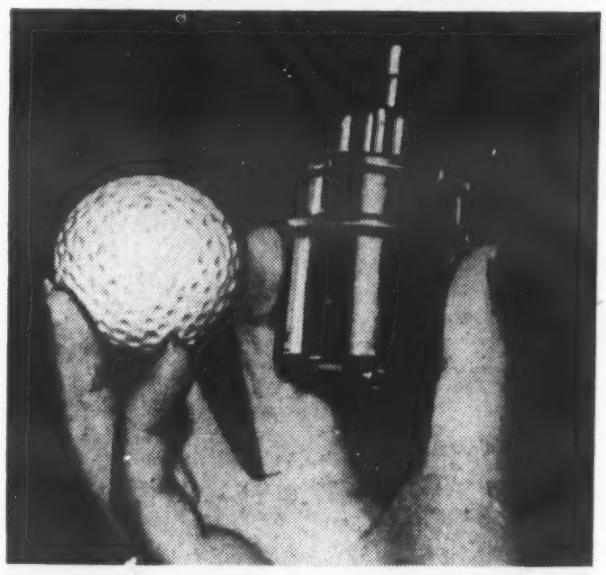
About the size of a golf ball and weighing only eight ounces, this new tube is the same type as the "mystery development" of World War II that enabled Allied radar to pin-point enemy ships and planes through fog and darkness with great accuracy.

The new tube is 50 times more powerful than the klystron tube it was designed to replace and uses far less filament battery power. It transmits on a frequency about 100 times higher than that used by FM broadcasting stations.

Commercial uses of the tube are also possible, such as in radar speed control systems now in use on superhighways and through some community thoroughfares.

This tube was developed in the Microwave Tubes Branch at Evans Signal Laboratory, a Signal Corps Engineering Laboratories component, under the direction of G. Ross Kilgore, Director of the Electron Devices Division. Microwave Associates, Inc., of Boston is under Signal Corps contract to produce the tubes from laboratory specifications.

The miniature magnetron compared in size with an ordinary golf ball. Weighing a mere eight ounces, it is 50 times as powerful as the klystron tube it replaces.



Camera Records Guided Missiles

A camera that will keep an eye on guided missiles in flight and be carried aloft either in a missile or aboard a chase plane, has been produced at the Gordon Enterprises, North Hollywood, California.

Tagged the 55 GE, the new camera device is but a little larger than a man's hand, and can attain operational rates as high as 200 pictures per second.

Purpose of the equipment is to obtain a perfect photographic record of the flight path and performance of a missile in the air, recording missile instrumentation as well as terrain and sky or horizon, all in the same strip of film.

Admiral to Build New Electronic Research Center

Admiral Corporation has broken ground in Palo Alto, California for a new electronic research center to be situated on a three-acre site in Stanford Industrial Park.

The new laboratory will provide facilities for the expansion of Admiral's Advanced Development Section which has been located in another part of Palo Alto for more than four years.

According to John F. Gilbarte, vice president of Admiral's Government Laboratories Division, the

(*Continued on page 76*)

NOW

molded printed electronic circuits

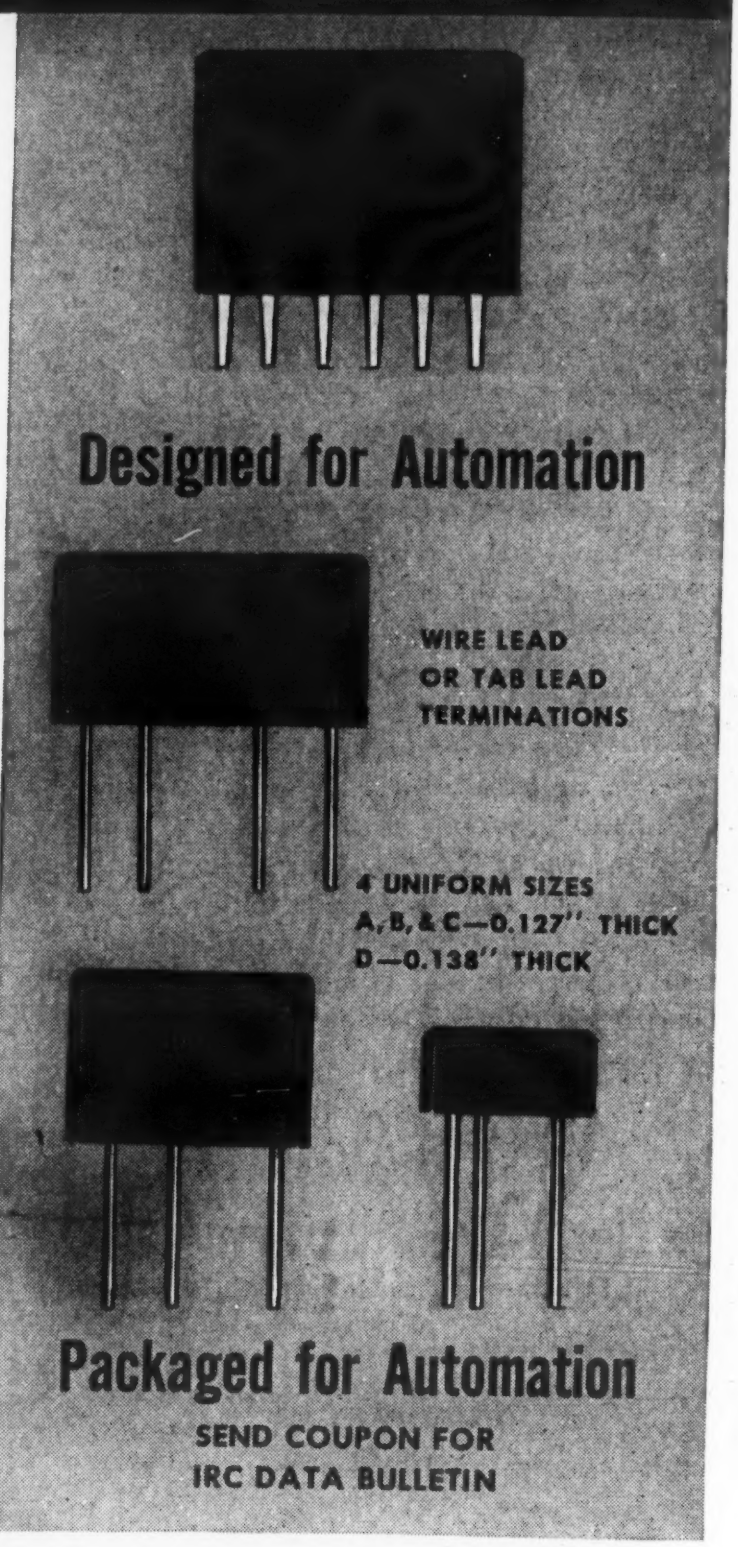
Improved circuit plate assemblies are available from IRC. Combining unsurpassed experience in producing film type composition resistors and precision molding skills, IRC again aids the advance of electronics. Type MCR Printed Electronic Circuits are fully protected by an exclusive *molded* enclosure. The entire assembly is a sturdy, compact, wafer-thin unit—ideal for automation.

Type MCR features

- greater moisture resistance
- less load-life change
- uniform terminal spacing
- unaffected by vibration
- competitively priced
- better temperature coefficient
- no possibility of "shorting"
- easier handling

Typical applications

- vertical integrators
- coupling circuits
- diode filter circuits
- triode coupling circuits
- interstage connectors of audio amplifiers



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building will house precision equipment and other scientific apparatus required in research and development work on military projects in the fields of guided missiles, radar systems, air navigation, nuclear radiation measurement, direction finding and communications, as well as on the company's civilian products.

Interceptor-Fire Control Simulator Developed

An interceptor-fire control simulator, recently developed by West Coast Electronics Company of Los Angeles, is designed to simulate the operation of an interceptor-fire control system of the E-4, E-9 or E-10 type rocket during the attack phase of interception.

Termed the Model 10, this device provides a means for simulating targets in straight line or accelerated flight. Pursuit, lead-pursuit and lead collision attack are simulated at the discretion of the operator.

This training device has special application as research equipment for use in investigation of pilot problems pertinent to the operation of radar-interceptor fire control systems, or for use in laboratory design studies of cockpit controls and displays.

In design of the simulator, particular emphasis has been placed on flexibility of simulation. It is adaptable, with a minimum of change, to interceptor-fire control systems that may be developed in the future.

Personnel

Botkin Returns to AT&T; ODM Post Goes to Matejka

Harold M. Botkin has returned to the American Telephone and Telegraph Co.'s Long Lines Department upon conclusion of his one year of service as Assistant Director of Telecommunications for the Office of Defense Mobilization.

Mr. Botkin has been named to a newly-created post in the AT&T, Assistant to the Vice President in charge of the Long Lines Department.

During his year in Washington, much has been accomplished by the telecommunications organization. A plan for emergency control of communications in event of attack has been completed. In another area, analyses were made of the steps that might be taken to minimize vulnerability to interruption of domestic and international communication facilities.

Succeeding Mr. Botkin at ODM is Major General Jerry V. Matejka. Until his appointment, General Matejka had been working in the ODM telecommunications organization as a consultant, having been detailed there by the Army until his retirement from active duty on October 31.

General Matejka has had a long and distinguished career with the Signal Corps and in logistics, having served as Commander of Fort Monmouth, New Jersey; Chief Signal Officer of the European Command; and Deputy Chief of Staff for logistics of the Allied Forces Central Europe.

Gavin and Martin Take Posts In Army Research and Development

Lieutenant General James M. Gavin, USA, formerly Deputy Chief of Staff for Plans and Research, has been named by Secretary of the Army Wilbur M. Brucker to the newly created post of Chief of Research and Development.

Also recently named to another R&D post is former Deputy Assistant Secretary of Defense for Applications Engineering William H. Martin, who becomes Director of Army Research and Development.

In his new position, General Gavin will be responsible for planning, reviewing and implementing any research and development. In addition, he will be responsible for coordination of such activities with the Department of Defense and other Armed Services.

In announcing Mr. Martin's appointment, Secretary Brucker stated, "The Director of Research and Development will be accorded the same degree of responsibility as that given to an Assistant Secretary and will have complete authority in this field, reporting directly to the Secretary of the Army. The Director will be in charge of all plans, implementation and financing of research and development projects Army-wide."

Pence New Chief of Signal Plans and Operations

Brigadier General William P. Pence, formerly special assistant to the Chief Signal Officer, has assumed his new duties as Chief of the Signal Plans and Operations Division in the OCSigO.

Prior to reporting for duty in the Office of the Chief Signal Officer in June 1955, General Pence had served for three years as Signal Officer of the 7th U.S. Army in Europe.

As Chief of the Signal Plans and Operations Division, General Pence relieves Colonel William M. Thames who has been designated Assistant Chief of the Division.

Signal Corps Scientific Chief of R & D Dies

Edward L. Nelson, Scientific Chief of Research and Development for the Army Signal Corps, died recently at his home in Arlington, Va.

A prominent figure in the communications industry, Mr. Nelson began his career by joining the engineering staff of the Western Electric Company in 1917. He later transferred to the Bell Telephone Laboratories, where he served as supervisory engineer and later as Radio Development Engineer responsible for the design and development of commercial radio transmitting and receiving equipment.

During World War II, Mr. Nelson was in charge of numerous military radio and radar projects of the Bell Laboratories for the Army and Navy.

Immediately prior to his appointment as Scientific Chief of Research and Development for the Signal Corps, he served as Technical Director of the Signal Corps Engineering Laboratories at Fort Monmouth, New Jersey.

Admiral Carney to Become Consultant to Westinghouse

Admiral Robert Carney, who retired in August as Chief of Naval Operations, will become a consultant to the Westinghouse Electric Corporation.

In announcing the appointment, Westinghouse President Gwilym A. Price stated, "Because of Admiral Carney's long and varied background in the Navy we know that he will be able to give us much practical guidance, particularly from the standpoint of operational requirements for military equipment."

General Corderman Promoted To Major General

Brigadier General W. Preston Corderman, Deputy Chief Signal Officer, was recently promoted to Major General in a brief ceremony at the Pentagon.

General Corderman, a native of Hagerstown, Maryland, is a graduate of the United States Military Academy, class of 1926. He became Deputy Chief Signal Officer in May 1955.

PERSONNEL CLEARING HOUSE

AFCEA Members Available to Industry

The pages of SIGNAL are open to active AFCEA members who are seeking positions in the communications, electronics and photographic industries. Any member is entitled to space free of charge in this column for three issues of the magazine. Please limit your notice to five lines. In replying, employers are asked to address: Box ....., SIGNAL, 1624 Eye Street, N. W., Washington 6, D. C. Letters will be forwarded to the AFCEA member.

PURCHASING AGENT, EXPEDITING, SUB-CONTRACT Administration. Electronics and associated fields, raw materials and components. 31 years old, 6½ years experience. Seek opportunity with foremost organization in communication field. Compansation secondary to real opportunity. Highly referenced. Box 114.

MANUFACTURERS' TECHNICAL OR SALES REPRESENTATIVE. Twelve years experience in mechanical, ordnance and photographic engineering and associated fields. Full knowledge of Government specifications, standards, contract negotiations and procurement regulations. Free to travel or relocate. Box 115.

EXECUTIVE ASSISTANT, CONTROLLER OR PROCUREMENT DIRECTOR. Experienced negotiator and financial administrator, top management caliber. Degrees in business and in law, admitted to New York Bar. Twelve years experience with airborne electronics procurement and with business affairs of a microwave test equipment manufacturer. Box 116.

Government and Military Positions Available

Government and military agencies are invited to use this column to announce available positions which may be of interest to the readers of SIGNAL. Notices will be published three times if not cancelled before. Applicants apply as indicated in individual notices.

ELECTRONIC SPECIALISTS are urgently needed at the Corps of Engineers Research and Development Laboratories, Ft. Belvoir, Va. Applicants must hold a degree in electrical engineering, physics or mathematics, or have considerable research experience in their fields. Salaries range from $4345 to $8940 per year, commensurate with education and experience. Apply to Walter H. Spinks, ERDL, Ft. Belvoir, Va.

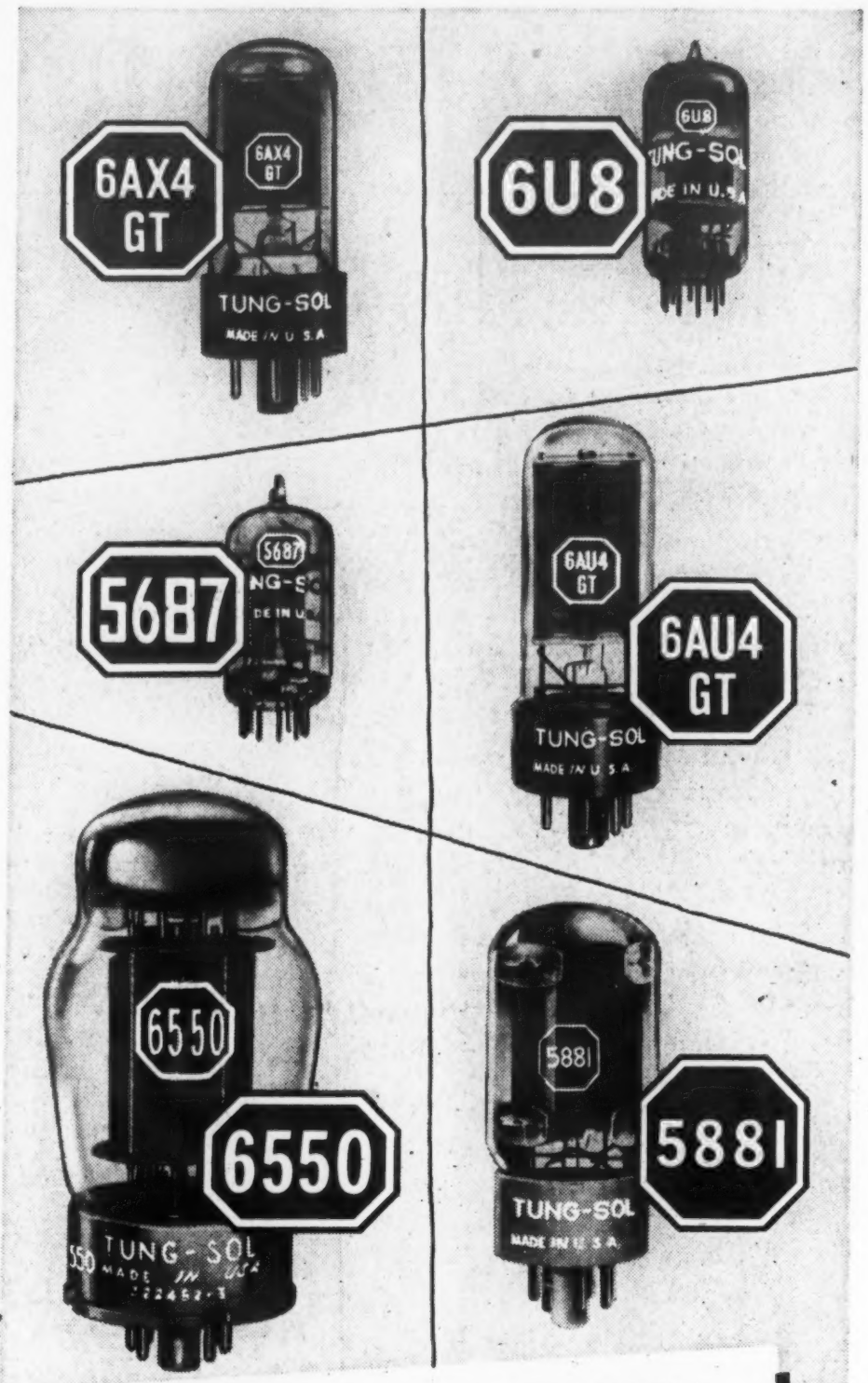
THE SPECIAL DEVICES CENTER, Office of Naval Research, located 25 miles from New York City at Port Washington, Long Island, needs electronic and aeronautical engineers. Applicants must possess degrees in engineering, and pertinent electronic or aeronautical engineering experience. Apply to Mr. David A. Lana, Industrial Relations Dept., Special Devices Center, Office of Naval Research, Port Washington, N. Y.

A CONSIDERABLE NUMBER OF CIVILIAN positions are now being created at the Presidio of San Francisco to replace certain military now occupying administrative positions. These openings include Civil Service Commission rated electrical engineer, civil engineer, mechanical engineer, and architectural engineer. Applicants should apply directly to the Civilian Personnel Division, Building 36, Presidio of San Francisco, California.

RADIO OPERATOR TECHNICIANS. Veterans $3400-$4200 to start. Overseas opportunities. Amateur or commercial licenses helpful. Full pay during advance training. Good advancement opportunities. Submit resume with name, age, address, phone number—if any, military experience, private training, work experience, FCC licenses—if any. Armed Forces Communications and Electronics Association will forward same immediately to employer who will acknowledge your application direct.

TELETYPE OPERATORS AND CRYPTOGRAPHIC TECHNICIANS. Veterans $3200-$3700 to start. Overseas opportunities. Full pay during training period. Good advancement opportunities. Submit resume with name, age, address, phone number—if any, military experience, FCC licenses—if any. Armed Forces Communications and Electronics Association will forward same immediately to employer who will acknowledge your application direct.

THE UNITED STATES CIVIL SERVICE COMMISSION has announced examinations for Microphotographer, $2,960 to $3,670 a year, Photostat Operator and Blueprint Operator, $2,960 to $3,415 a year, and Photographer, $2,960 to $4,525 a year, for filling positions in various Federal agencies in Washington, D. C., and vicinity. Appropriate experience or training is required. No written test is required for Photographer positions, but for the other positions, a written test will be given. Further information and application forms may be obtained at many post offices throughout the country, or from the U. S. Civil Service Commission, Washington 25, D. C. Applications will be accepted by the Commission in Washington until further notice.



NEW PRODUCTS from Industry

G-E Micro-Miniature Ceramic Triode for UHF Television

A radical new concept in receiving tube design has been announced by General Electric Company in the form of a tiny "micro-miniature" ceramic triode for UHF television sets.

This micro-miniature triode, 6BY4, is an all metal-and-ceramic tube about 3/8" long and 5/16" in diameter.

Preliminary ratings on this particular tube are based on an operating frequency of 900 megacycles. Development work at the G-E Receiving Tube Sub-Department in Owensboro, Kentucky, indicates production models soon will be available with a noise factor of approximately 51 decibels when operating at this frequency with a bandwidth of 10 megacycles.

Although the first version of this new concept in vacuum tubes is designed for television sets, other uses are indicated by the amazing heat-resistance of the tube. It will actually operate while glowing red-hot at a temperature of about 1000°F. This is far beyond the point at which glass melts and approaches the heat found in some instances inside jet engines, guided missiles and perhaps man-made satellites.

Frequency-Diversity Microwave Equipment by Motorola

Microwave equipment which provides maximum circuit continuity has been announced by Motorola Communications and Electronics, Inc.

Two simultaneous beams at different frequencies are transmitted to a distant station. The same information is impressed on both beams, and the receiver automatically selects the better signal received.

The equipment was developed for special applications requiring maximum possible reliability, such as transmission of automatic long-distance dialing signals in a commercial telephone system.

Equipment is available for locally-controlled indoor or remotely-controlled outdoor installation. Microwave transmitter and receiver units are packaged in plug-in boxes for fast efficient maintenance. A single antenna system transmits both beams.

Micro-miniature in size, the new General Electric 6BY4 can be designed into UHF tuners and converters to reach new standards of amplification and low noise at high frequencies.

Tower-mounted reflectors provide extra height for "line of sight" transmission. Equipment remains on the ground for easy servicing, and transmission lines up the tower are eliminated. "Sensing" circuits detect any abnormal equipment condition, switch receiver output accordingly and actuate an alarm indicating the nature of the trouble.

Du Mont Repeater Station For Mobile Radios

Allen B. Du Mont Laboratories, Inc., have developed a high-performance repeater station for mobile radio designed to provide extended car-to-car or point-to-point communications.

Designated as the Model MCA-454-A repeater station, the new unit is now available for communications systems operating within the frequency range of 450-460 megacycles. Fully proved circuitry results in exceptional performance, versatility, and dependability for the user who has need of repeater station operation or requires greater signal coverage.

Completely self-contained, the unit incorporates transmitter, receiver, termination panel and power supply in a single cabinet.

Input power to the final radio stage is limited to 50 watts, thus permitting operation on the Class "A" Citizens Band (460-462MC and 468-470MC) as well as 450-460Mc operation.

The MCA-454-A is housed in a sturdy metal cabinet with front and rear removable doors for complete accessibility. Both doors are equipped with safety interlocking switches and automatic resetting disabler buttons.

Long Life Nuclear Battery

The development of a nuclear battery that converts nuclear energy into electrical energy has recently been announced.

Capable of performing reliably under temperature conditions ranging from —60°F to +160°F, the battery has an operating life in excess of 25 years. The disintegration of Strontium 90 is used as the energy source; the company states that the external radiation of the battery is within the Atomic Energy Commission tolerance limits.

Three models are available with voltage and current ratings ranging from 1 to 10,000 volts and 5 to 2,000 micromicroamperes.

One of the models is a multiple voltage source with taps at 1, 10, 100 and 1,000 volts and a current of 2,000 micromicroamperes. Another supplies a voltage of 375 volts at a current of 50 micromicroamperes.

A third model is a high voltage source supplying 10,000 volts, with a current rating of 500 micromicroamperes. This model is less than 5 cubic inches in size.

Automatic Electric Designs Loudspeaking Telephone

A new loudspeaking telephone for the Independent telephone industry has been developed by Automatic Electric Company of Chicago.

This new instrument, recently exhibited at the U.S. Independent Telephone Association convention, is designed to serve those who desire to have both hands free, or to move about while talking over the telephone, as well as for use in those cases where a number of persons need to participate in a telephone conversation at one time.

A microphone in the base of the instrument picks up the voice or voices using the telephone, while a small loudspeaker carries the voice or voices at the other end of the line.

According to Automatic Electric, the loudspeaking telephone provides a high degree of fidelity, with none

(*Continued on page* 80)

and ready to "scramble".....

America's Armed Forces, alert and on guard, are ready to swiftly defend our country or to strike back at the enemy. Hallicrafters is alert to this emergency which requires dependable electronics equipment. Our facilities are *now* developing, perfecting and producing secret equipment for the Air Force and other branches of the service. The unmatched experience of over twenty years in electronics, plus the lessons gained in producing vital communications during World War II and the Korean conflict, make Hallicrafters a "Primary Producer" for the United States Armed Forces.

World's leading exclusive manufacturers of communications radio

hallicrafters

4401 West Fifth Avenue, Chicago, Illinois

HALLICRAFTERS FACILITIES ARE NOW BEING USED FOR THE DEVELOPMENT AND PRODUCTION OF: GUIDED MISSILE CONTROL EQUIPMENT • COMMUNICATIONS EQUIPMENT • COUNTER-MEASURE EQUIPMENT • COMBAT INFORMATION CENTER • HIGH FREQUENCY ELECTRONIC EQUIPMENT • MOBILE RADIO STATIONS • MOBILE RADIO TELETYPE STATIONS • PORTABLE TWO-WAY COMMUNICATIONS EQUIPMENT • RADAR RECEIVERS AND TRANSMITTERS (ALL FREQUENCIES) • RADAR EQUIPMENT.

of the "squawk box" effect so often associated with devices of this kind.

To make a call using the loud-speaking arrangement, the caller presses a button, dials in the usual way but does not life the handset, and then presses another button to "hang up." A small control knob enables the user to adjust the volume to his needs.

The instrument may be used at will as a conventional telephone by pressing a button and then using the handset in the customary manner.

Device Tests Airborne Weather Radar Performance

To meet commercial airline requirements for weather radar installation test equipment, the Narda Corporation is now producing the Model 833 Echo Box.

During the radar transmitted pulse, microwave energy is stored in the echo box. Immediately following the pulse, energy is returned to the radar over the same path producing a signal or target on the radar indicator

At the end of the pulse the returned energy decays exponentially finally disappearing into the background noise clutter at a point determined by the receiver sensitivity and transmitter power output. Therefore, the time interval between the beginning of the transmitted pulse and the point where the signal on the radar indicator disappears into the noise measures the over all performance of the radar.

In addition to determining over all radar performance, the Narda echo box facilitates tuning adjustments and obtains an approximate spectrum analysis. Other characteristics which may be determined are: low transmitter power output, long receiver recovery time, improper pulling and local oscillator frequency.

Versatile Ceramic Material From Raytheon

Raytheon Manufacturing Company of Waltham, Massachusetts, has recently announced the development of a versatile new ceramic called type R-95.

It is especially suitable for manufacture of items in either small or mass production quantities where a precision ceramic is preferred and where high uniformity in body composition and consistent quality are desirable.

Type R-95 ceramic can be metallized for subsequent soft or hard soldering operations, and thus can be used in the manufacture of ceramic-to-metal assemblies. Its properties include high temperature resistance, abrasion resistance, electrical insulation, and high thermal and mechanical shock resistance.

Shown above are a wide variety of sizes and shapes which can be made from type R-95 ceramic recently developed by Raytheon Manufacturing Company of Waltham, Massachusetts.

Philbrick Operational Amplifier

A new operational amplifier, Model K2-X, has been added to its line of electronic analog components by George A. Philbrick Researches, Inc., Boston, Massachusetts.

Using this plug-in type high gain amplifier as a base subassembly, feedback computing devices of all speeds may be assembled with only the simplest of wiring. Featured in this new unit are balanced differential inputs for minimum drift and maximum utility, high performance and economy of operation.

Among the many feedback operations which can readily be performed are: addition, subtraction, integration, differentiation, proportioning, inversion, impedance-conversion and the injection of current.

Tube Shield Provides Cooling and Vibration Protection

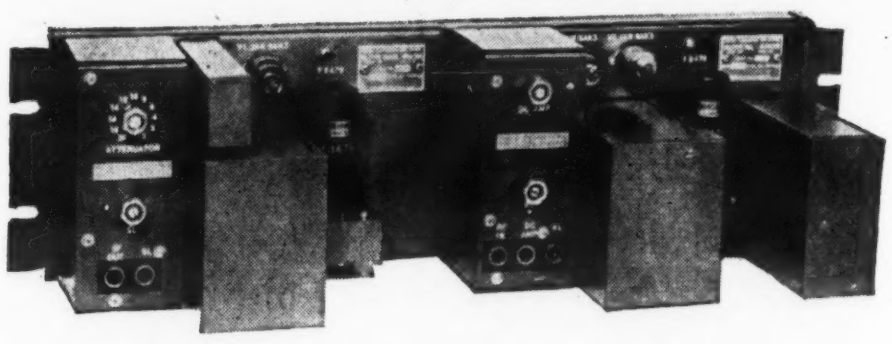
International Electronic Research Corporation of Burbank, California, is now marketing a heat dissipating tube shield, designed for direct replacement of JAN-type shields.

When this temperature-rated shield is used, up to 50% reduction of the bulb temperature reached when the tube is enclosed in a standard JAN shield is attained, resulting in greatly increased reliability. When used on low wattage tubes, the shields reduce bare bulb temperature by 20 to 25%.

(*Continued on page* 82)

FREQUENCY-SHIFT V-F CARRIER-TELEGRAPH SYSTEM

Provides one, two, or three frequency-shift teletype channels above the voice on a 3400-cycle telephone circuit



A send and a receive panel require 5¼" of mounting space on a standard 19" rack

This system provides an economical trouble-free method of obtaining up to three full-duplex 100 wpm telegraph channels at the upper end of a broad-band telephone channel, and still retain a 2950-cycle voice circuit. Mid-channel carrier frequencies of 3120, 3240 and 3360 cycles are employed. The mark frequencies are 30 cycles below and the space frequencies are 30 cycles above the mid-band frequencies. The three telegraph channels are transmitted in the band 3080 to 3400 cycles, leaving the band below 2950 cycles for the voice channel.

Fault-free teletype circuits are obtained, even where the telephone circuit on which they are superimposed suffers from noise or abrupt level variations which may be so great as to render on-off keyed signals unintelligible. Frequency-shift signals do not suffer deterioration from non-linear transmission, such as is caused by overloading in voice-frequency, carrier or radio equipment. Under most circumstances a signal-to-noise ratio per channel as low as 20 db is satisfactory, and under some conditions even lower ratios result in fault-free operation. This equipment meets the requirements of current MIL specifications wherever applicable.

RADIO ENGINEERING PRODUCTS

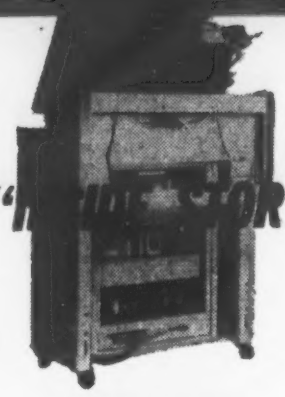
1080 UNIVERSITY STREET, MONTREAL 3, CANADA

Telephone: UNiversity 6-6887 Cable Address: Radenpro, Montreal

MANUFACTURERS OF CARRIER-TELEGRAPH, CARRIER-TELEPHONE AND BROAD-BAND RADIO SYSTEMS

alfax paper has made possible . . .

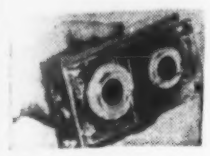
This "[illegible]" of Alden Equipment —— for Instant, Visible Recording!



REAR VIEW
19" RECORDER

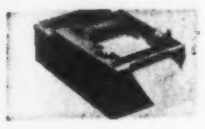
Alfax opens new horizons with this Alden equipment . . .

GROUP A Designates recorders in which the paper is moved past fixed recording electrodes



Magazine Fact Finder — 2 Channels plus timing

Here's a compact Magazine Recorder which will permanently record two separate operations and automatically print a recurring time signal on the Alfax Tape. Simple to install — they will operate unattended—remotely or on the spot.



Multi-Channel Fact Finder — 30 Channels plus timing

Now it's possible to monitor and permanently record 30 operations simultaneously on Alfax Paper. This 30 Channel Fact Finder is portable for lab or bench use, yet easily adapted for rack mount. Construction is simple, yet rugged, and as the paper is smooch-proof, unaffected by humidity, or even rain, the instrument can be located anywhere.

GROUP B Designates recorders in which the "Flying Spot" records traverse of the moving paper

Flying Contact Spot Recorder

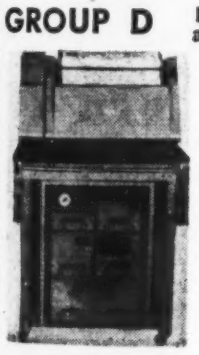
Tremendous amounts of related information can be recorded accurately in a very small space using the Alden adjusterless Helix Sweep Recorders. Complete and "do it yourself" Helix Recorder components are available for continuous paper rolls of 2", 5", 8", 12" and 19" widths. Helix and paper feeds are supplied with external shafts for drives best suited to your own recording needs or are supplied with special drives to your own specifications.

GROUP C Designates a group "B" recorder with electronics added for curve plotting

Alden Curve Plotters

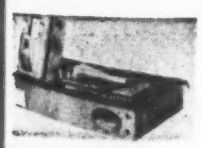
The Basic Helix Recorder with special electronics can provide continuous, automatic plotting of any phenomena that can be converted to voltage. Any number of channels can be recorded simultaneously along with standard or reference signals so that the information is instantly and permanently self-calibrated.

GROUP D Designates group "B" basic recorders with added electronics to provide high speed and continuous, automatic, facsimile transmissions — featuring automatic start and stop and fast phasing.



Continuous Reproduction Facsimile System

Extremely high quality reproduction of large copy: such as newspapers, weather maps, blueprints, finished advertising layout, drawings, photographs, etc. can be transmitted easily with this equipment. Copy is scanned flat and reproduced automatically on remote continuous recorder.



High Speed Selective Dispatch System

Specially designed to permit selection of pertinent data from any copy — letters, dispatches, reports, etc. — for instant transmission of vital bursts of information, wherever needed — yet complete reproductions can also be sent. 72 square inches of copy, 1800 words of newspaper type, or 900 words of typewriter text can be transmitted and received per minute.

GROUP E Designates recorders in which any original is enlarged.

Alden Giant Bulletin System

Fastest accurate means of disseminating information to large groups of people. Automatically provides changing "up to the minute" bulletins 4 feet wide and up to 10 feet high — enlarged 10 times from remote flat copy scanner. May be indoors or out, since extreme weather conditions will not hamper its operation. Able to record 12 square feet of copy per minute as sent out from a remote transmitter station either by wire or a microwave system.

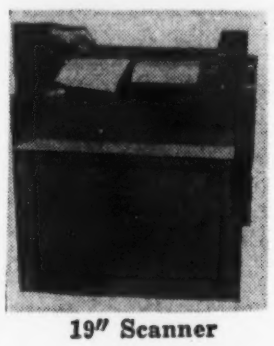
SOON TO BE ANNOUNCED! ALDEN GROUP F

A completely integrated Fact Finding Department — in one compact package — including equipment from each of the groups described above — making it possible to instantly, visibly record for analysis any phenomena or action that can be converted into an electric pulse or voltage. Pipe in any kind of pulse and instantly get a recorded picture.

19" Recorder

• SIMPLE TO INSTALL....

All equipment is designed for simple "on the spot" installations. Some you just roll in and plug in — Others are hand-carried — for bench, rack or machine mounting and in the most extreme case, unit construction makes it possible for 2 men to hand carry any unit through a door or window. Anyone can set up for instant use, any place, even in a tent!



19" Scanner

• SIMPLE TO OPERATE....

All recorders operate virtually unattended after being set into motion by the pressing of a button — Some recorders operate continuously for up to 8 days without requiring new paper — flat copy scanning requires only the pressing of a button — slipping copy under a roll. Anyone can operate the equipment.

19" Recorder

• SIMPLE TO SERVICE....

All equipment is designed on the unit construction, "Building Block" principle — making it a simple matter for anyone to remove and replace mechanical parts and even electronic circuits. All electronic circuits are mounted on Alden Plug-in Unit chassis — Tell Tales indicate malfunctioning units which can be just slipped out and replaced by anyone in second's time.

TRANSMITTING WITH THE ALDEN SCANNER

Alden 2" Flat Copy Scanner

The Alden Facsimile Flat Copy Scanner is made possible by the great sensitivity of ALFAX PAPER. The principle of the Alden Flat Copy Scanner is this: Moving roll feeds copy. Electric eye sees flying spot line by line; as copy advances reflected light on copy varies current in electric eye sending it over wire or radio to recorder . . . Here flying contact marks ALFAX PAPER whenever electricity passes through paper, moves line by line in step with the scanning transmitter.

RECEIVING WITH ALDEN RECORDERS

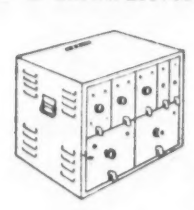
Alden 19" Recorder

Alfax Paper and Alden Techniques makes possible mile after mile of adjusterless, unattended recording with these Alden Techniques designed into each recorder:

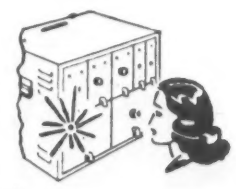
- Recording takes place in the paper chamber
- Self compensating electrodes
- Limited but uniformly constant pressure of contact
- Constant and self compensating back pressure on paper
- Unit system of plug-in construction for all elements
- Self aligning paper holders with automatic spring action
- Paper tensions divided into separate sections
- Release or reduction of contact pressure
- Self aligning stops for exact electrode positioning

ALDEN SERVICING CONCEPT AS DESIGNED INTO THE EQUIPMENT

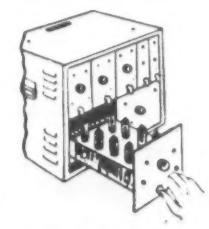
All mechanical parts are made on the unit principle so they just drop in—slip in—or snap in—or when fastened by screws, use Alden Target Screws which can be inserted or removed with a coin for a screwdriver.



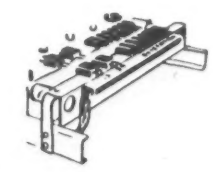
1 Circuitry subdivided function by function into plug-in units



2 Tiny telltales spot trouble instantly



3 Plug in replacement spares in 30 seconds



4 All leads brought to single accessible point of check — all numbered color-coded — so layman can make first-level tests

ALDEN ELECTRONIC AND IMPULSE RECORDING EQUIPMENT CO.
Alden Research Center **Westboro, Mass.**

NEW PRODUCTS

These shields provide complete electrostatic shielding and effective cooling of electron tubes to within the manufacturer's recommended operational temperature ratings for longest tube life and dependability.

They are ideal for a wide range of applications including present military, airborne guidance, navigational and communication equipment. Other practical uses are in naval and commercial shipboard electronic gear, electronic business machines, hi-fi equipment and radio and television sets.

Ultra Fine Precision Flat Wire

Hamilton Watch Company's Allied Products Division recently announced that it is now in commercial production of very fine flat wire, held to extremely close tolerances of thickness, width, and uniformity of cross section.

A special process produces a wire with better than mirror surface finish; of uniform thickness and width; and with smooth, rounded edges. Thickness can be held to a tolerance of ±.00001 inch and width to a tolerance of .001 inch. The wire is produced with freedom from twist, so that spiral springs made of it lie flat, permitting easy assembly.

Hamilton Watch Company's special fine flat wire compared to a human hair.

This precision flat wire is available from a maximum size which is .019 inch in overall width and .010 inch thick, down to the minimum size, which is .003 inch in overall width and .0007 inch thick.

Suggested applications of this wire are for the springs in precision timing elements, in high precision electrical and aneroid instruments, and in high sensitivity electrical relays. It also has excellent application possibilities as the supporting element in high-sensitivity torsion suspensions, such as those used in oscillograph galvanometers and in delicate torsion balances.

First 5-Watt, 6-Volt Transistor Introduced

To fill the ever growing need for a transistor with greater power than presently available, a New York firm has recently introduced a P-N-P junction power transistor that delivers 5 watts push-pull output with a 6 volt supply.

Called Type 2N115, this transistor is internally insulated from its metal case so that no external mica insulation is needed when mounting the unit on a chassis. The output impedance is low enough for a popular 5 ohm speaker voice coil to be used directly as the collector load in the audio output stage, so that expensive output transformers are not needed.

The 2N115 is ideal for use in the output stage of automobile radios, either single-ended or push-pull. It can also be used as an oscillator, running from a 6 or 12 volt supply, such as a television flyback circuit, to deliver high voltages to vacuum tube amplifiers. Other applications include use as a servo amplifier, a clocking pulse amplifier in computers and a power switch.

Fairchild Potentiometer

A new potentiometer providing a resistance range of 50 to 70,000 ohms with a standard linearity of ±0.15% has been announced by the Potentiometer Division of the Fairchild Controls Corporation, a subsidiary of the Fairchild Camera and Instrument Corporation.

Precision-built to close tolerances and guaranteed for long service and sustained accuracy, the new Type 747-E "pot" offers an innovation. A special clamp band provides an unrestricted tapping area allowing up to 19 taps and presents a simplified means of phasing units in a ganged assembly without disassembling the units.

The low noise level and high resolution of these units make them particularly desirable for computer assemblies, calibration controls, servo mechanisms and other similar applications.

Transistorized D.C. Transformer

An extremely small, lightweight, transistorized D.C. transformer has been placed on the market by the Nader Manufacturing Company, Monrovia, California.

This unit is completely static, and therefore has no bearings to wear out or need adjustment, and no brushes or brush parts to be replaced. Maintenance costs are eliminated, and operating costs are confined to simple replacement of parts after long service.

Occupying only 10 cubic inches—1/4 the volume of rotary equipment—the unit is well suited for miniaturization applications. It is square in shape, thus using space more efficiently.

Operating principle involves the conversion of D.C. to a square-wave A.C. signal. This is stepped up or down in a transformer, and then rectified to give D.C. output.

Shock and vibration characteristics are excellent, and the unit is unaffected by altitude. Operating life under normal operating conditions is indefinite.

A.C. Rotary Solenoid

Leetronics, Division of Lee Spring Company, Inc., Brooklyn, New York, has announced the development of a rotary solenoid, ideal for 60 cycle A.C. operation.

Designed basically for A.C. use, the solenoid can be operated by standard voltages without the use of rectifiers, transformers, etc. The pure rotary movement produced at the shaft simplifies application by eliminating the need for counter-balancing the spiral action of some rotary devices.

The torque developed by the solenoid provides all the desirable force

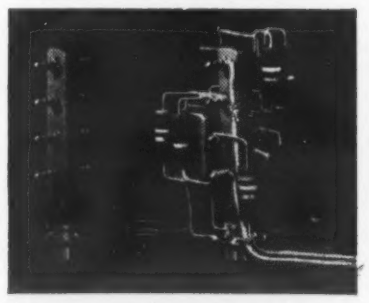
(*Continued on page* 84)

for that short grid lead

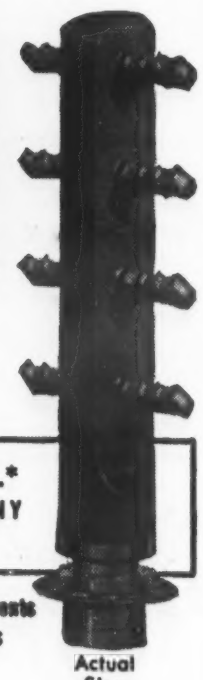
use the Sangamo

Tote-m-pole

First used in Navy electronic gear, Tote-m-poles are invaluable for "bug-resistant" wiring of models and production units. Advantages: Short leads; high component density; improved ventilation.



Tote-m-pole supporting "T" network of 5 resistors and 4 capacitors.



Actual Size

CUSTOM COMPONENTS SEC.*
SANGAMO ELECTRIC COMPANY
SPRINGFIELD, ILLINOIS

*H. V. Power Supplies • Inductive Components
Servo Instruments • Low-X Resistors

The new TELETYPE 28 Printer offers these outstanding features...

1. **FEATHERWEIGHT CARRIAGE** . . . quick, dependable carriage return even at 100 wpm—needs no extra line signal.

2. **TYPEBOX PRINTING** . . . instantly removable Typebox for changing type or cleaning.

3. **SELECTOR** . . . high speed, low current pulling magnet selector.

4. **POWER KEYBOARD** . . . light, uniform key touch gives new operator ease, efficiency.

5. **CONTROLS** . . . all at front, all by keyboard button, for operator's convenience.

6. **SIGNAL GENERATOR** . . . single contact design . . . polar or neutral signals.

7. **ALL METAL CLUTCHES** . . . No slip . . . no idling load . . . infrequent lubrication.

8. **BUILT-IN STUNT BOX** . . . offers unlimited variety of signaling, switching, control operations.

The new high speed Teletype 28 printer marks a new era in the field of printing telegraphy. It is a machine engineered not only to meet today's most complex communication problems . . . but with built-in facilities to solve new problems as they arise.

If you would like to complete your file with technical information on this new Teletype Printer, write to our new customer service office: Teletype Corporation, Dept. S-11, 4100 Fullerton Ave., Chicago 39, Ill.

TELETYPE CORPORATION
SUBSIDIARY OF
Western Electric Company

characteristics of conventional linear type solenoids, but permits easy installation without levers and linkages.

Because of its rotary design, the Leetronics Solenoid is unaffected by vibration and shock, and operates perfectly in any mounting position. Eight basic sizes provide a wide range of forms, offering a variety of torque values from fractional inch-pound to 62.5 inch-pounds at maximum stroke on continuous duty models. Intermittent duty models for high torque values are available.

Bendix Synchronizer-Power Supply for Airborne Radar

Bendix Radio Division of the Bendix Aviation Corporation has announced the development of a new synchronizer-power supply unit for the Bendix X-band and C-band airborne weather radar systems.

The SYN-1B weighs 21 pounds—27 pounds lighter than its larger predecessor which has been used since the Bendix airborne weather radar was introduced last year. In going to the lightweight design, Bendix Radio engineers have also reduced the number of vacuum tubes from 32 to 19.

Only one of several improvements on the Bendix weather radar system, this synchronizer-power supply is designed to be operated with the industry-standardized gyro output voltages and incorporates a flush-mounted blower.

Roesch Cabler Offers Solution To Automation Problem

Douglas Roesch, Inc., Los Angeles electronic manufacturers, have announced the completion of a new Planetary Cabler designed to offer a solution to the problem of supplying "custom" electronic cable in prototype or production runs.

This device has successfully fabricated intricate cables from fragile strands of conductors, delicate coaxial circuits, precision balanced quads and power leads into one manageable cable length.

Pictured above is the Planetary Cabler developed by Douglas Roesch, Inc., of Los Angeles. This entirely new machine has been designed and built to provide complex reliable cables or complete prototype components to keep pace with the designers' program for better performance and reliability.

The Planetary Cabler is believed by Roesch to be the answer to many current problems in the field of automation in general, and, in particular, it has direct application to the guided missile, computer and atomic energy fields.

Bulletins & Catalogs

Allied Radio Announces 1956 Catalog

Allied Radio Corporation of Chicago, distributors of electronic parts and equipment, has announced the release of its 1956 general catalog. The 324-page catalog lists over 26,000 items.

This catalog features the latest in high-fidelity components, including 34 complete hi-fi systems; television chassis, boosters, rotators and UHF converters; professional and home recording equipment; public address amplifiers and complete systems; amateur radio equipment; and industrial VHF radio and radio-telephone equipment.

The catalog is available upon request to the company.

Hansen Tape Resistor Bulletin

"Tape Resistors and Their Application to Miniaturization" is the title of a new bulletin now available from Hansen Electronics Company of Los Angeles.

This bulletin, written to expand data given in previous brochures, describes tape resistors, gives their characteristics and discusses design consideration affecting printed circuitry and miniaturization.

Copies of the bulletin are obtainable upon request to the company.

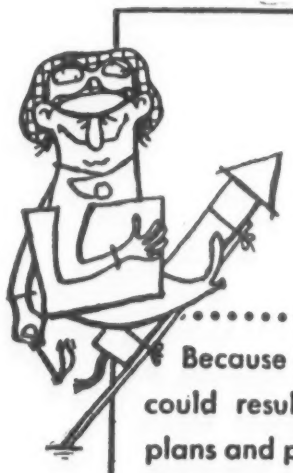
RCA Microwave Radio Relay Manual Announced

The Government Service Department of the RCA Service Company, Inc., has prepared a 226-page service manual on wave propagation and other aspects of VHF and microwave radio relay systems.

The publication, entitled "Point-to-Point Radio Relay Systems—44MC to 13,000MC," was published originally under contract for the U.S. Air Force which has approved the reprinting and commercial sale of the volume.

Containing a large number of charts, curves and nomograms for

(*Continued on page* 86)



"Periculum in mora!"

(THERE IS DANGER IN DELAY)

Because late delivery of your handbook requirements could result in financial reverses for you, COASTAL plans and processes your job with extreme care to insure delivery on time. Our reputation was built on quick delivery and high quality!

COASTAL..... SPECIALIZING IN THE PREPARATION OF INSTRUCTION BOOKS FOR INDUSTRY AND GOVERNMENT.

COASTAL PUBLICATIONS CORPORATION
130 WEST 42ND STREET
NEW YORK 36, NEW YORK
LOngacre 5-4478

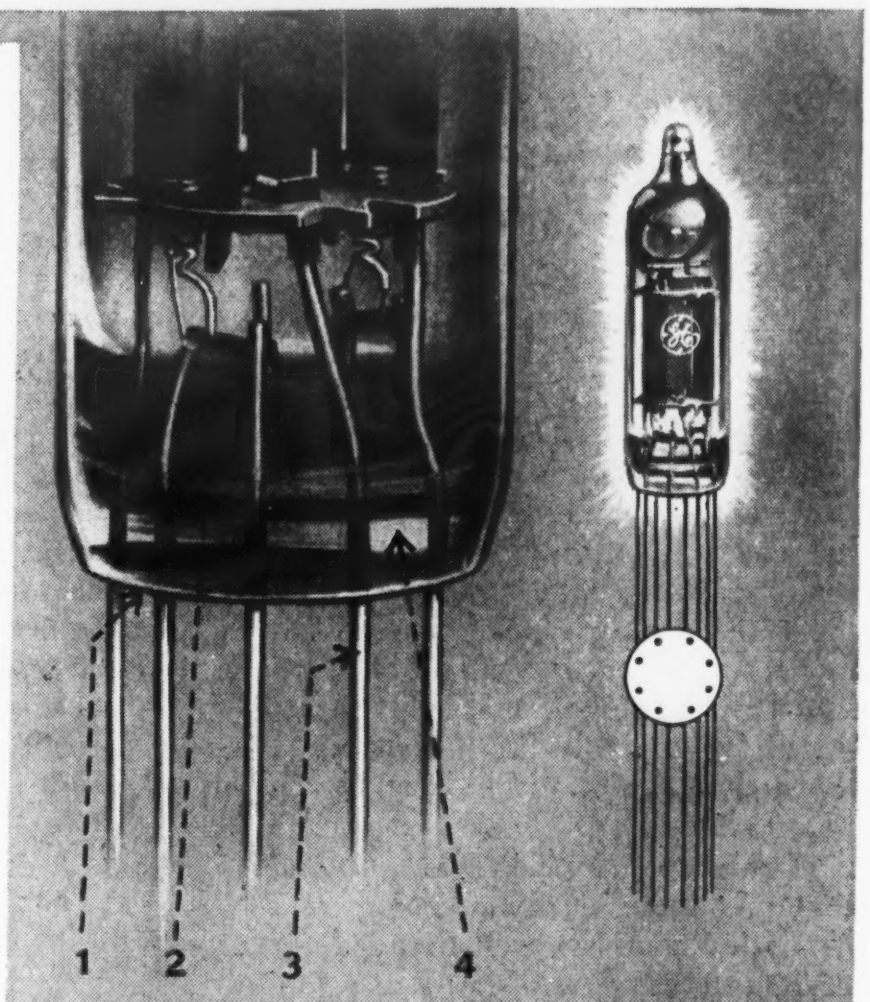
BUTTON-STEM BASE OF G-E 5-STAR SUBMINIATURES INCREASES RELIABILITY...LENGTHENS TUBE LIFE!

1 G-E 5-Star subminiature leads—spaced out circumferentially—are more than twice as far apart as with pressed-stem base construction, where the leads are in line. Also, spacing is more accurate and uniform. These widely-spaced leads help ward off glass electrolysis (which increases rapidly with higher temperatures) in the area where leads pass through the seal of the tube envelope. *Means a longer-life seal and tube,* since electrolysis, a result of electrical leakage, breaks down the glass to a point where vacuum is impaired and tube failure can occur.

2 5-Star leads within the tube and seal are short, and parallel one another for a minimum distance—unlike pressed-stem internal leads, which are long and extend side-by-side. Result: *5-Star tube capacitance is lower,* giving improved circuit performance, especially at high frequencies.

3 8 external leads in all are available with 5-Star subminiatures, against a maximum of 7 for pressed-stem tubes. With many tube types, this *provides increased flexibility for the circuit designer.* For example, only button-stem subminiature twin triodes can offer the designer separate cathode connections!

4 Button-stem base construction makes 5-Star subminiatures *nearly 10% shorter (approx ⅛ inch) than pressed-stem tubes.* Equipment designers who face strict space limitations, benefit from G-E 5-Star compactness!



Above: actual size. Seated height of tubes is only 1.375 inches (max). Circular diagram over base pins shows how circumferential arrangement of leads in G-E 5-Star subminiatures, spaces them more widely apart than the in-line leads of pressed-stem tubes.

Add to these advantages of button-stem base construction, special 5-Star design throughout—sturdy, shock-resistant, electrically efficient and dependable! Add painstaking tube manufacture by selected, trained G-E 5-Star workers, in a separate 5-Star building where employees wear lint-free garments, and the air is pressured, filtered, and dehumidified to keep out dust!

General Electric 5-Star tubes are the most reliable subminiatures you can install. Ask for them in new equipment! Use them as replacements! *Tube Department, General Electric Company, Schenectady 5, New York.*

18 G-E 5-Star subminiatures are available, for a comprehensive range of circuit applications:

5718	5896	6021
5718-A	5896-A	6021-A
5719	5899	6111
5719-A	5899-A	6111-A
5840	5902	6112
5840-A	5902-A	6112-A

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fast and easy calculating, the manual has chapters devoted to such subjects as "Basic Wave Propagation," "Path Attenuation," "Fading," "Weather versus Propagation," "Ionospheric Transmission" and other technical points.

For the Photographer

Picture-Forming Plastic Developed

Deep photographic images can be developed by heat through flexible film that can now be made with Bakelite vinyl resins for uses such as decoration, display and photo-recordings.

Known as Calimar, this picture-forming plastic has been developed by Ferro Chemical Corporation of Bedford, Ohio, under sponsorship of the U. S. Army Signal Corps. Calimar consists of an organosol paste based on Bakelite vinyl resins produced by the Bakelite Company, a division of Union Carbide and Carbon Corporation.

A mixture of this paste, containing light-sensitive, dye-forming, and catalytic chemicals is ball-milled for 20 hours, then drawn down on a supporting backing to form a photo-sensitive film. When dried and cured, this film is three-thousandths of an inch thick and self-supporting.

Exposed through a photographic negative to ultra-violet light and developed by heating, the film bears a continuous tone photographic image extending clear through from top to bottom surfaces.

The depth of this image, combined with the resistance of Bakelite vinyl resin base film to wear, moisture and chemicals, produces a photographic reproduction with unusual durability. The image is also resistant to sunlight bleaching. In moderately heavy film, the deep image produces a three-dimensional effect.

These qualities fit Calimar for production of decorative film, bearing durable, continuous tone photographs or patterns, instead of halftone, surface decoration obtained by conventional printing processes. Durability of the photo-decorated film also makes it useful for reproducing maps, blueprints and line drawings.

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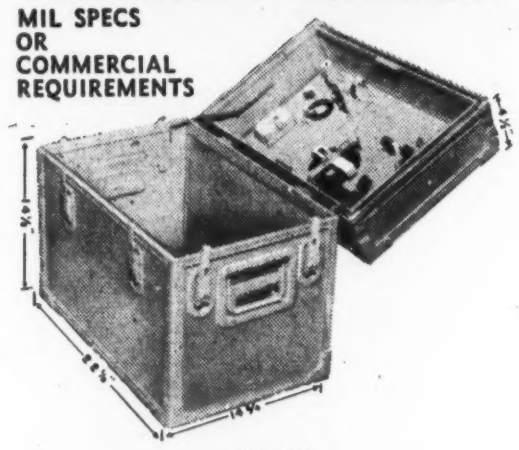
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Automatic Sub-Miniature Still Camera

A new automatic sub-miniature still camera, the Ga Mi 16, imported from Italy by a New York firm, is now available in the United States.

The camera measures 4½ inches long, 2⅛ inches wide, 1 inch thick and weighs 10 ounces. It uses either perforated or non-perforated 16mm film and has a frame size of 12 by 17mm. When perforated film is used the picture size is reduced to 10 by 17mm.

Equipped with a six-element, all coated f/1.9 Galileo Esamitar lens, this camera is fully color corrected for color, black-and-white and microfilm.

A spring motor transports the film and cocks the shutter for three sequence shots. The motor is wound each time the front cover is closed. Up to three exposures can be made as rapidly as the shutter release button can be pressed.

Other features of the camera are: double exposure prevention, automatic shutter lock when the camera is closed or the film used up, exposure counter, depth-of-field indicator and built-in tripod socket.

Bell & Howell Filmosound Projector

A new model of the Bell & Howell Filmosound 16mm motion picture projector was announced recently by the Bell & Howell Company of Chicago, Illinois.

Called the Filmosound 385, it produces four times as much sound volume at low voltage as previous models. The added power, not needed for normal operation, provides reserve gain to compensate for variation in film prints and to assure full sound volume in low voltage areas.

Increased sound volume is provided by a completely new 15 watt amplifier, a new voltage regulator which keeps the voltage to the photo cell constant, and an eight inch speaker.

Like its predecessors, the Filmosound 185 and 285, the new 385 has an all gear drive. It throws a brilliant picture on the screen and reproduces sound clearly. It projects both silent and sound film, operates in forward or reverse and may be stopped to project a single picture.

When used as a public address system, an improved microphone-phonograph input accommodates both sensitive broadcast-type microphones normally of low voltage output and crystal phonograph record players of relatively high output.

New Film Makes Transparencies Available Immediately

A new system of photography that is expected to change picture-viewing habits in homes, schools and business conference rooms was demonstrated recently at the Photographic Society of America convention.

A new film that produces black-and-white transparency slides for projection on a screen a minute or two after the shutter is snapped has been developed by the Polaroid Corporation of Cambridge, Mass. With this film and the simplified projector that completes the system, the process now produces pictures for big-screen projection as quickly and as easily as paper prints.

Faster than any other film ever marketed, it has an ASA meter rating of 1,000. Its great speed makes it possible to use lens-settings that keep details sharp at all distances in the scene, from the foreground to the horizon.

This film is the first to combine extremely high speed with ultra-fine grain. Under close examination, the projected pictures hold together and show freedom from the usual grain-structure. Slides from this film reproduce twice the brightness range in nature that can be reproduced by good paper prints.

ANTENNA MULTICOUPLER

MODEL AMC-6

The AMC-6 Antenna Multicoupler is a broadband coupling device covering the frequency range of 2 to 30 megacycles. A single AMC-6 provides for the operation of up to six HF receivers from a single antenna without interference or interaction. The unit provides an average power gain of 10 db with a noise factor comparable to a good communications receiver.

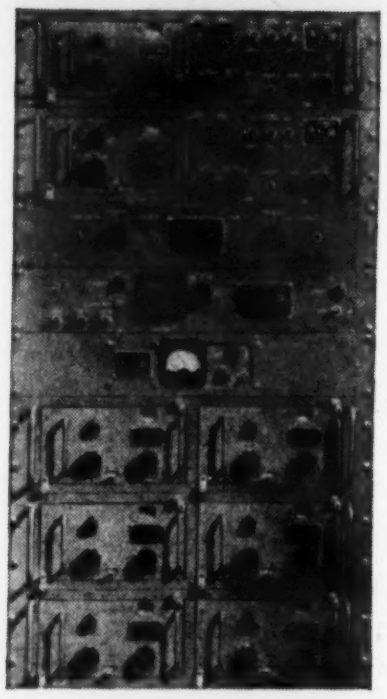
Particular attention has been paid to "cascade operation" permitting a larger number of receivers to operate from a single antenna. Complete details available on request.

AN/CU 5013( ) SRR

BULLETIN 155A

DIVERSITY RECEIVING PACKAGE

MODEL DRP-1



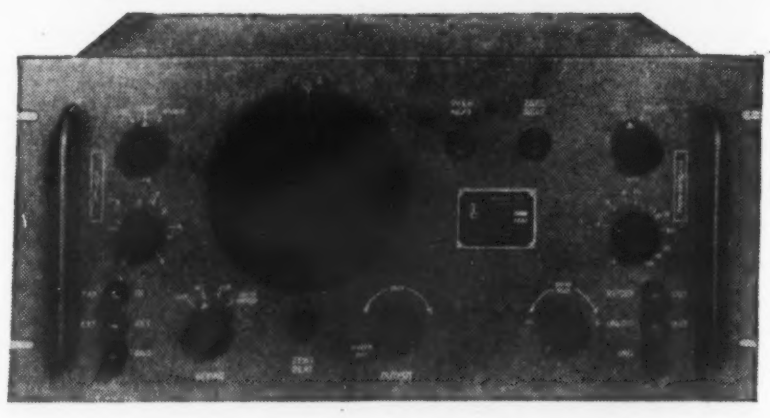
The DRP-1 Diversity Receiving Package, was designed to provide a compact, easy to operate equipment, capable of receiving AM, FS, CW and MCW signals within the frequency range of 2 to 32 megacycles. The basic receiver used is the TMC Model FFR (AN/FRR 502). Plug-in Tuning Drawers provide for quick frequency change. VFO or crystal operation is provided.

Frequency Shift operation is provided by the TMC Model CFA Converter and the TMC Model PSP-1 furnishes local battery. A selectable Mark/Space filter panel reduces adjacent channel interference. Complete information and details are available on request.

BULLETIN 170

FREQUENCY SHIFT SIMULATOR

MODEL FSS



The FSS Frequency Shift Simulator provides a primary source of controllable Frequency Shift Signals for testing and adjusting communications equipments. The Frequency Shift range is adjustable from ±10 cycles to ±5 kilocycles around Center Frequencies of 400 cycles to 16 kilocycles.

An adjustable Pulse Generator provides keying up to 600 dot cycles and a separate Bias Control provides up to 50% Mark/Space Bias.

The FSS will accept external MARK/SPACE pulses or linear signals, (FAX). The internal Sweep Generator simulates FAX signals and produces linear sweep for visually checking audio amplifiers, discriminators and filters. An internal Mixer System permits checking of external frequency shift devices. Available with cabinet or for rack mounting.

BULLETIN SSB 171

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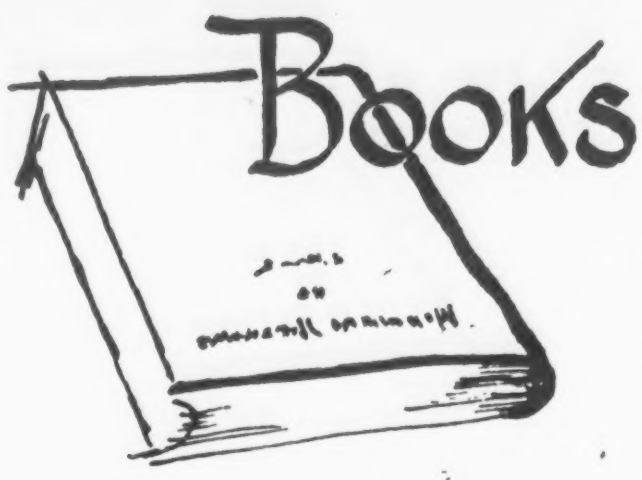

GUIDANCE — PRINCIPLES OF GUIDED MISSILE DESIGN. Arthur S. Locke and Contributing Authors from The Naval Research Laboratory, D. Van Nostrand Company, Inc., Princeton, N. J., 729 pages, $12.50.

Although our country is not actively engaged in warfare, and the cold war seems to be thawing out somewhat, it is still necessary for our scientists and industries to continue developing and perfecting weapons for our national defense.

Guidance has been compiled by several authors and covers every phase of guided missiles from the mathematic groundwork up. It entails the different methods of obtaining intelligence of a target by employment of infrared, radio and acoustic waves, and fixing its location by terrestial and celestial references.

An analysis of the several flight trajectories, the uses of radar in tracking targets, and bandwidth studies are given in detail. Guidance problems arising during the prelaunching and launching phases, economic consideration, the influence of guidance systems, computation and telemetry are other topics covered in this volume.

One in a series edited by Captain Grayson Merrill, U.S.N., on the principles of guided missile design, this book is an invaluable background reference for those entering the field and should be most helpful to those already involved in this type of work.

ELECTRONIC AND RADIO ENGINEERING, Fourth Edition. Frederick E. Terman, McGraw-Hill Book Company, Inc., New York, N. Y., 1078 pages, $12.50.

A thoroughly new revised edition of Terman's *Radio Engineering*, the title reflects an increased emphasis on the general techniques of electronics, as well as complete coverage of all important engineering aspects of electronics.

The fourth edition, in three parts, presents a comprehensive treatment of the basic engineering knowledge relating to vacuum tubes, transistors, electronic circuits, and radio systems that represent the working tools of every electronic and radio engineer.

Mr. Terman has completely rewritten the text in this new edition and every figure has been redrawn to keep abreast with the rapidly changing technology of this field. Important additions have been made to the text, including for the first time, a simple explanation of how the traveling wave tube and the backward-wave oscillator (carcinotron) operate. Over 1250 "Problems and Exercises" aid the reader in determining his comprehension of the various aspects of the field. This book should be invaluable to engineers and those entering the engineering field.

MAGNETIC MATERIALS IN THE ELECTRICAL INDUSTRY. P. R. Bardell, Philosophical Library, New York, N. Y., 288 pages, $10.00.

Little attempt to provide the electrical engineer with a guide to the mysteries of magnetism has been made in the past. Mr. Bardell alters this situation by reviewing the historic development, application and testing of permanent magnetics and of soft, magnetic materials, as well as a discussion of the influence of magnetic theory and a glossary of terms and units.

Professor James Greig, in his foreword says, "There is, in the authorship of this book, first-hand knowledge of the production, measurement, and application of certain classes of magnetic materials, which has been applied and extended to assessing critically the whole range in explicit relation to their applications. This treatment brings out clearly that the full realization of the high magnetic qualities of the modern materials is closely inter-related with the design of the systems in which they are to be utilized."

Senior students in physics and electrical engineering, teachers and all those engaged in research or industries concerned with magnetism and magnetic materials should find this book of great interest and value.

SWITCHING RELAY DESIGN. R. L. Peek, Jr. and H. N. Wagar, D. Van Nostrand Company, Inc., Princeton, N. J., 478 pages, $9.50.

Much of the speed and efficiency obtained in modern technology may be credited to the use of automatic controls. Switching relays have played a major role in new developments in household appliances, industrial processes, communication systems, aircrafts and weapons. They are essential elements in a wide variety of computing devices, automatic control apparatus, and telephone and telegraph systems.

This book employs a fresh analytical approach in developing the design relations of the mechanical contacting system and the actuating electromagnet of a switching relay, leading to an integrated treatment of the dynamic performance. It contains analytic procedures for evaluating the characteristics of an existing relay and for predicting those of a proposed design.

This text covers the most technical processes employed in switching relays. Analysis with charts, graphs and pictures are used to give the reader a better understanding of the various steps involved in setting up switching relays.

The material contained in this volume has evolved from texts for training courses in relay design given at Bell Telephone Laboratories, and draws on the accumulated experience obtained there in developing central office switching apparatus. The presentation serves both as an engineering text and a reference book and design manual for relay engineers.

RADIO OPERATING QUESTIONS AND ANSWERS, 12th Edition. J. L. Hornung and A. A. McKenzie, McGraw-Hill Book Company, Inc., New York, N. Y. 571 pages, $4.50.

Here is up-to-the-minute information necessary to help prospective radio operators pass the FCC License examinations.

In this, the 12th Edition, Elements 1 and 2 have been completly revised to keep in step with the FCC's recently issued Supplement No. 1 to the Study Guide and Reference Material for Commercial Radio Operators Examinations.

The book answers more than 1,900 questions covering such topics as ship radiotelephone, commercial broadcasting, frequency modulation, monochrome and color television, radiotelephone and radiotelegraph communication, broadcasting law, wave-guides, transistors and reduction of noise.

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All IRE members will devour this issue and treasure it as they have the history-making issues on Color TV, Transistors, Electric Computers, etc. This October number will rank high as a practical service to the whole industry—a great reference text of 380 pages—and someday become a collector's item among radio engineers.

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(*Continued from page* 31)

and J. J. Anderson, Vice President-General Sales Manager. Angus J. Walker, Director of Purchases, is a Lieutenant Colonel, USAR Signal Corps, Colonel Michael Leo Looney, USAR, is a member of the staff of the Washington office.

Many members of the staff have had first-hand experience with the problems of both war- and peace-time production. This knowledge, plus the company's modern facilities, enables it to solve a wide range of problems within the briefest development time. They also enable National Pneumatic Co., Inc. and its Holtzer-Cabot Divisions to continue to offer every branch of the Armed Forces reliable —and outstanding—service.

Man-Made Satellites

(*Continued from page* 19)

the scientists, who would probably prefer a sphere, as the optimum shape for observation and for instrument housing.

But these compromises must be resolved and the first satellite launched before the end of 1958 if the information obtained is to be useful during the IGY. Scientists are agreed that the project is feasible; they are hopeful of obtaining the necessary funds; it will remain only for engineers to get the satellite into its orbit—a job which will still present sizable and new problems.

Based on past performances, it seems safe to predict that this advance in science will be achieved, a step which has been compared with the Wright brothers' flight as another milepost in history. Without detracting from its importance, however, it should be remembered that a satellite will only complement the rocket as an upper-atmosphere research vehicle. Although the satellite has the advantage of collecting data over a "long" period of time, compared with a rocket, it has the disadvantage that it will collect this data only at one altitude level. Although the rocket can sample various layers of the atmosphere, even its usefulness is measured in terms of a few minutes' flight.

Another important fact, so far as the IGY is concerned, is that even though several satellites may be launched, and each launching may be successful, the United States will launch more than 600 rockets and rocket-balloon combinations in conventional vertical trajectories for geophysical and astrophysical purposes.

Electronics in the Fuzing of Modern Weapons

(*Continued from page* 28)

not be suitable for fuzing, since fuze functioning would take place upon the passage of a cloud as well as upon approach to a target. Since, however, the change in illumination occurs relatively slowly under the former, and rapidly under the latter condition, electronic circuits were developed to measure the rate of change in illumination, so that proper functioning was obtained.

The fuzes which have been described briefly above are obsolete. If they were not, it would have been impossible to give even the scant outline which has been presented, for proximity fuzes are still one of the closely-guarded secrets of defense.

Proximity fuzes and related electronic ordnance devices under current development are far more challenging than their forerunners, and the scope of the program is shown by the various branches of which the Diamond Ordnance Fuze Laboratories is composed. The Projectile Fuze Laboratory consists of the Electronics Branch, the Arming, Power & Structures Branch, and the Test & Evaluation Branch. The Electromechanical Laboratory has the Aircraft Ordnance Branch, the Impact Fuze Branch, and the Mine Fuze Branch. The Guided Missile Fuze Laboratory comprises the Surface Target Branch, the Air Target Branch, the Mechanical Engineering Branch and the Systems Branch. The Supporting Research Laboratory consists of the Ordnance Research Branch, the Electron Tube Branch, and the Components Material Branch. In addition, there is also the Industrial Engineering Division, comprising the Projectile Fuze, the Guided Missile, and the Industrial Services Branches.

SIGNAL plans to publish articles on the electronic work carried on in these Laboratories in subsequent issues, insofar as considerations of security permit.

Tube Reliability

(*Continued from page* 42)

(1) Improvement of present regulator tube;

(2) Development of an extremely rugged beam power tube for employment in communication equipment;

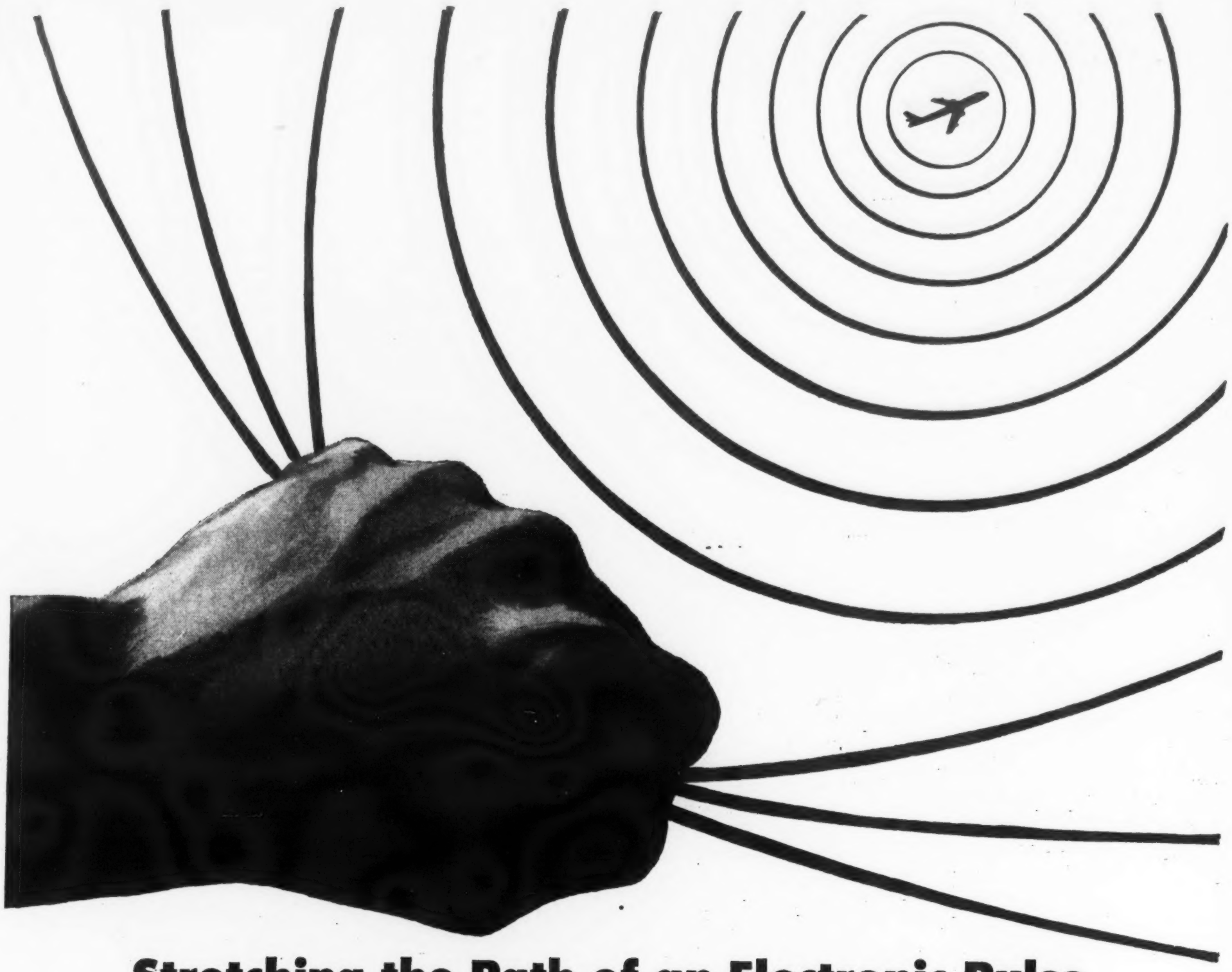
(3) Development of a rugged subminiature twin triode for severe conditions.

Another item under study in the Signal Corps is the reliability of hydrogen thyratrons with supporting work being accomplished contractually.

An important advance has been made toward tube reliability in a program referred to as the "Feedback and Integration of Results" program. Information and tubes are furnished to tube manufacturers for study and remedial action through the ARINC and Cornell channels previously described. This service has resulted in many major changes in design and processing of electron tubes.

Data for further improvements of reliable tube specifications are being accumulated directly from the field operations or by orderly review with other services and industries. Results are being incorporated in MIL specifications.

The importance of this entire reliability program cannot be overemphasized. As was stated in the beginning of this article, continuous operation of an equipment often depends on the efficiency of the electron tubes employed in the equipment. Although the Government is vitally interested in improvement of tactical equipments, it is a noteworthy fact that commercial interests are also being benefitted in this program. Results of environmental studies conducted throughout the world by ARINC and the analytical studies made by Cornell are made available to the Reliability Task Force for dissemination to the Services and industry and to such organizations as the Armed Forces Electro Standards Agency, the Armed Services Electron Tube Committee, the Aircraft Industries Association, and the Radio-Electronics-Television Manufacturers Association.



Stretching the Path of an Electronic Pulse

Military coding equipment takes one pulse and inserts it into a delay line and in effect sends it over a number of paths, each of different lengths. Combining the output of the paths gives a pulse train with pulses spaced in accordance with artificial length of the path. Ordinarily the flexibility of the equipment is limited by the fixed taps in the delay line and the accuracy is established by auxiliary circuitry.

Now Admiral research has developed a completely new type of delay line which is infinitely variable within its over-all capacity. It is adjustable with the greatest facility for any desired interval. The accuracy of this line is limited only by the accuracy of the measuring equipment. Moreover, the Admiral delay line requires less complicated switching apparatus. Weight and bulk are reduced. Fewer components permit faster production at lower cost. Here is one more example of Admiral's capabilities in the field of military electronics. Address inquiries to:

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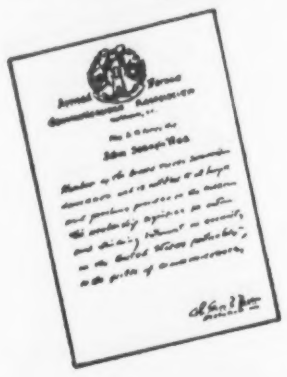

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